THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXI. No. 1561.] LONDON, APRIL 11, 1893. [45TH YEAR. PRICE 6d.

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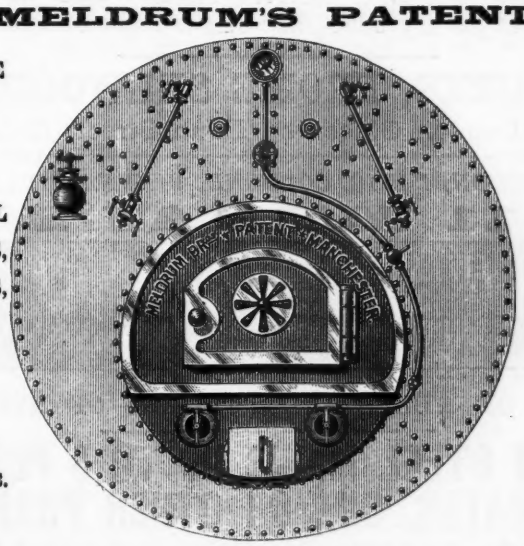

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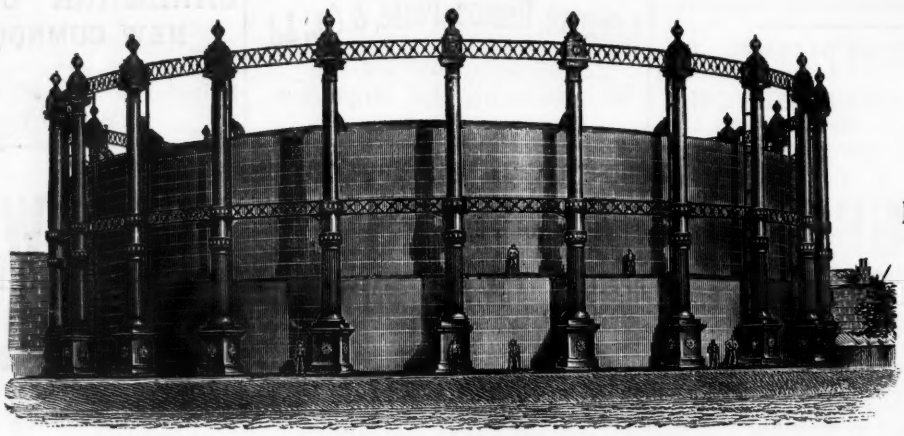

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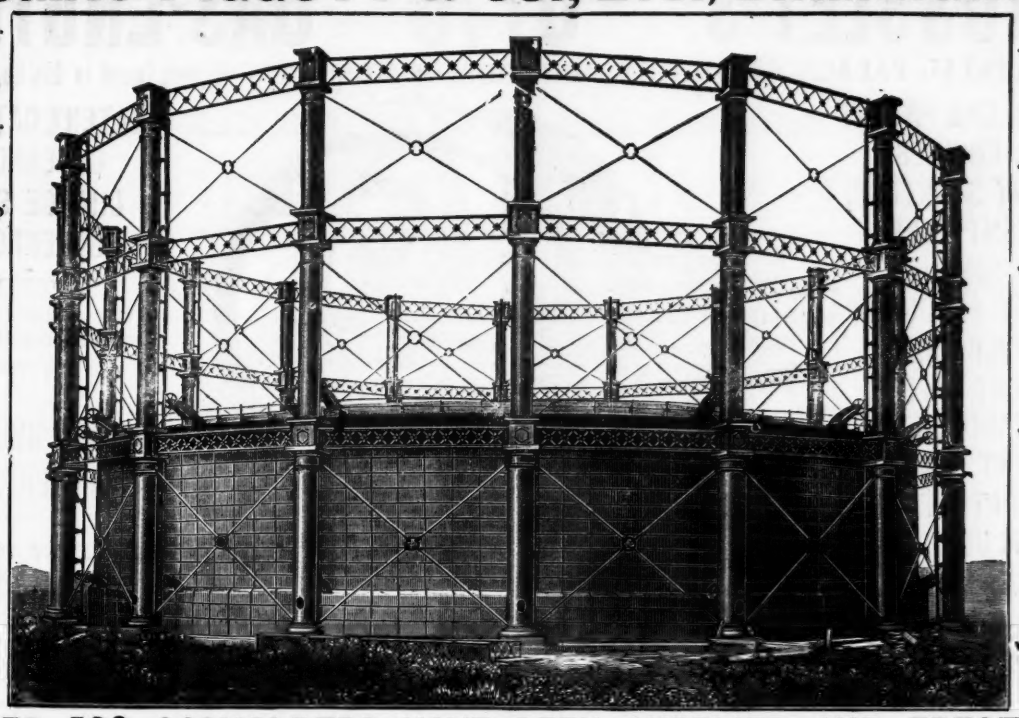

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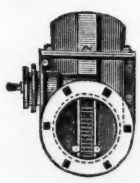

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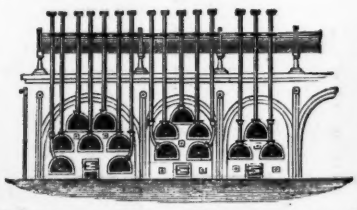

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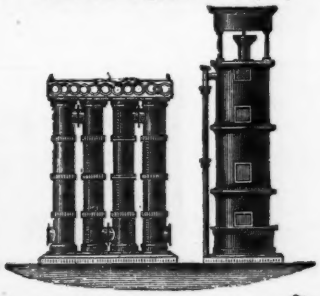

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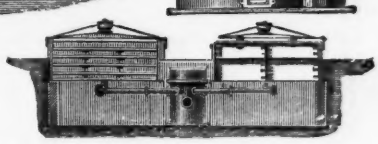

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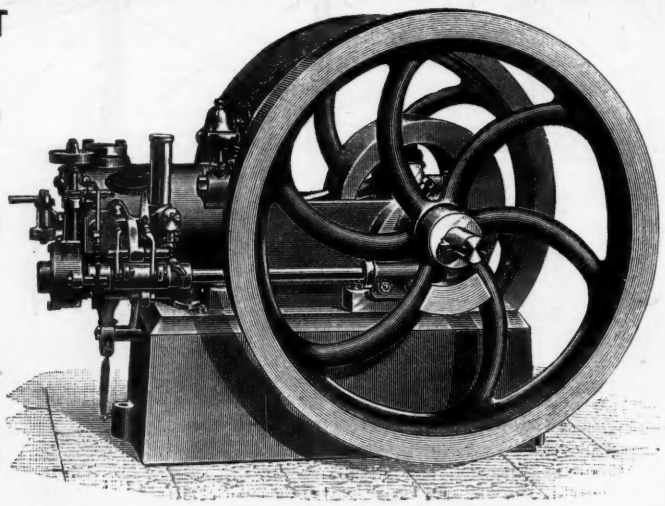

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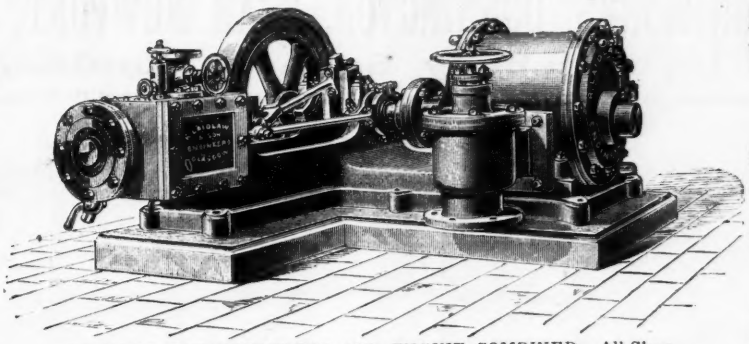

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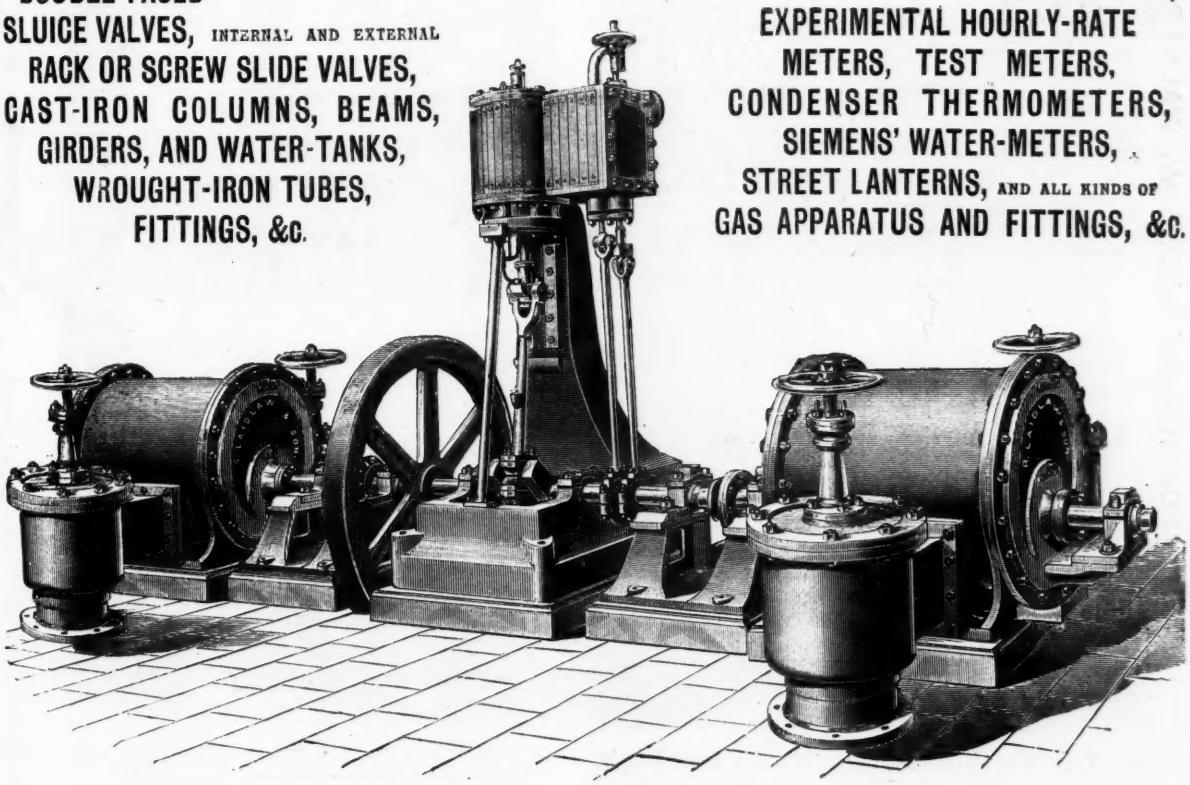

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Prices, with full Particulars, will be given on application.

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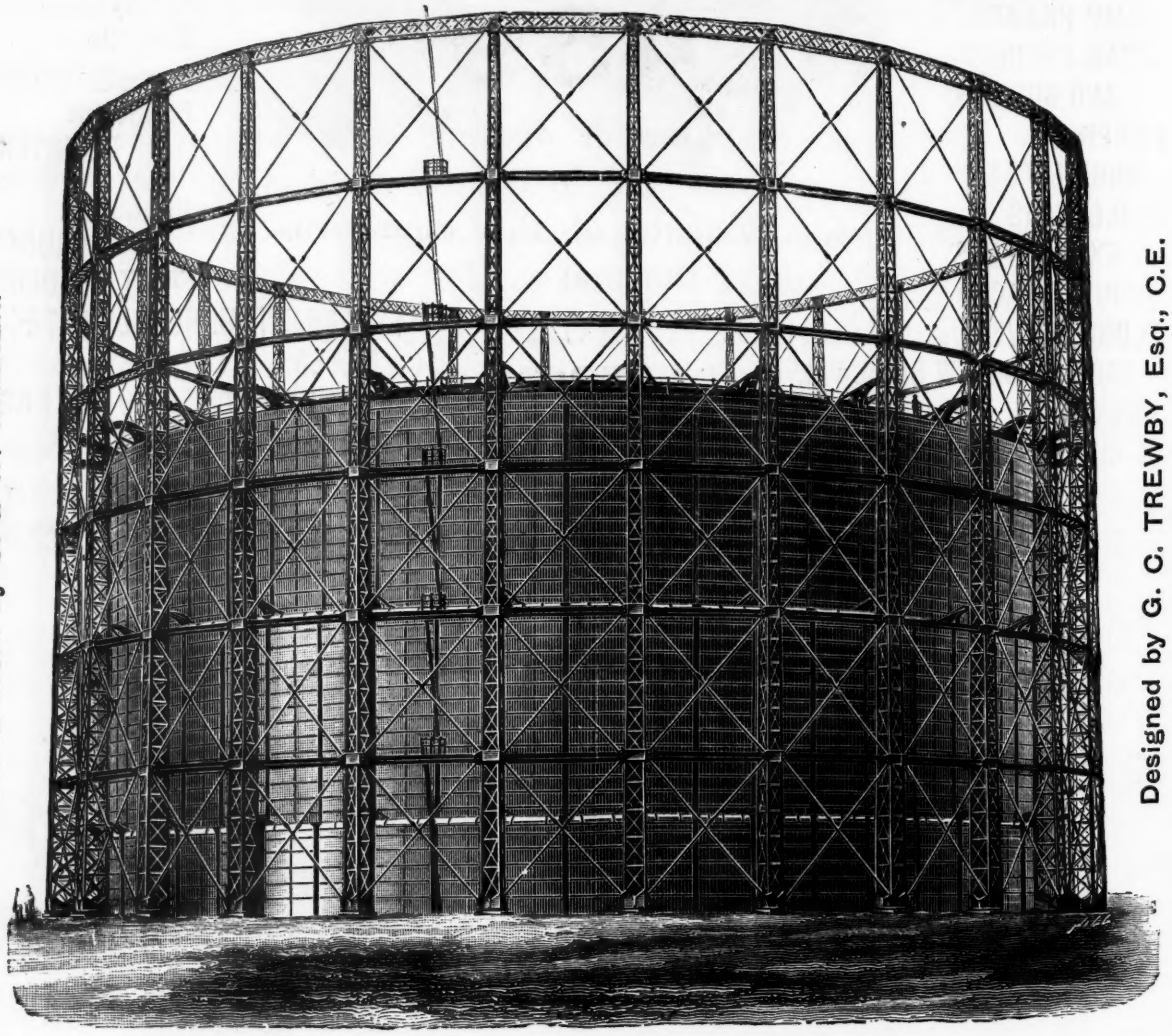

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Four-Lift Gasholder, nearly 200 feet high, and 8 million Cubic Feet capacity, recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

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Weck's Centre-Valve.

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(SIDNEY HERSEY, Managing Director.) (J. CHANDLER, Engineer.)

PATENT

"STANDARD" WASHER-SCRUBBER.

459

of these Machines (capable of dealing with 437,315,000 cubic feet of Gas daily) erected and in course of construction. These facts are given as evidence of the apparatus being the most efficient of any in the market for the extraction of

AMMONIA, CARBONIC ACID, AND SULPHURETTED HYDROGEN FROM COAL GAS.

A large number of the above Machines have been constructed according to the Company's latest Patent, which has also been applied to original pattern Machines at many Works.

TESTIMONIALS.

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Nov. 25, 1889.

MESSRS. KIRKHAM, HULETT, AND CHANDLER, LTD.,

Gentlemen,

In reply to your inquiry respecting the result of putting Wooden "Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.

I am, yours truly,
(Signed) G. C. TREWBY.

NOTE.—Orders since received for four 3,500,000 cubic feet per day Machines for Beckton; and two 3,000,000 cubic feet for Kensal Green, also for Patent Improved Wooden "Bundles" for original pattern Patent "Standard" Washer-Scrubbers erected at Beckton, Nine Elms, Shoreditch, Pimlico, and Bromley.

Extract from the JOURNAL OF GAS LIGHTING, &c., for Sept. 27, 1892, referring to the visit of the Members of the Eastern Counties Gas Managers' Association to the Lowestoft Gas-Works—

"Mr. J. Ayris has one of Messrs. Kirkham, Hulett, and Chandler's "Standard" Washer-Scrubbers in operation (capable of dealing with 500,000 cubic feet of gas per 24 hours); and of the working of this machine he spoke very highly."

Estimates furnished for cost of altering original pattern Patent "Standard" Washer-Scrubbers, or for the supply of New Machines.

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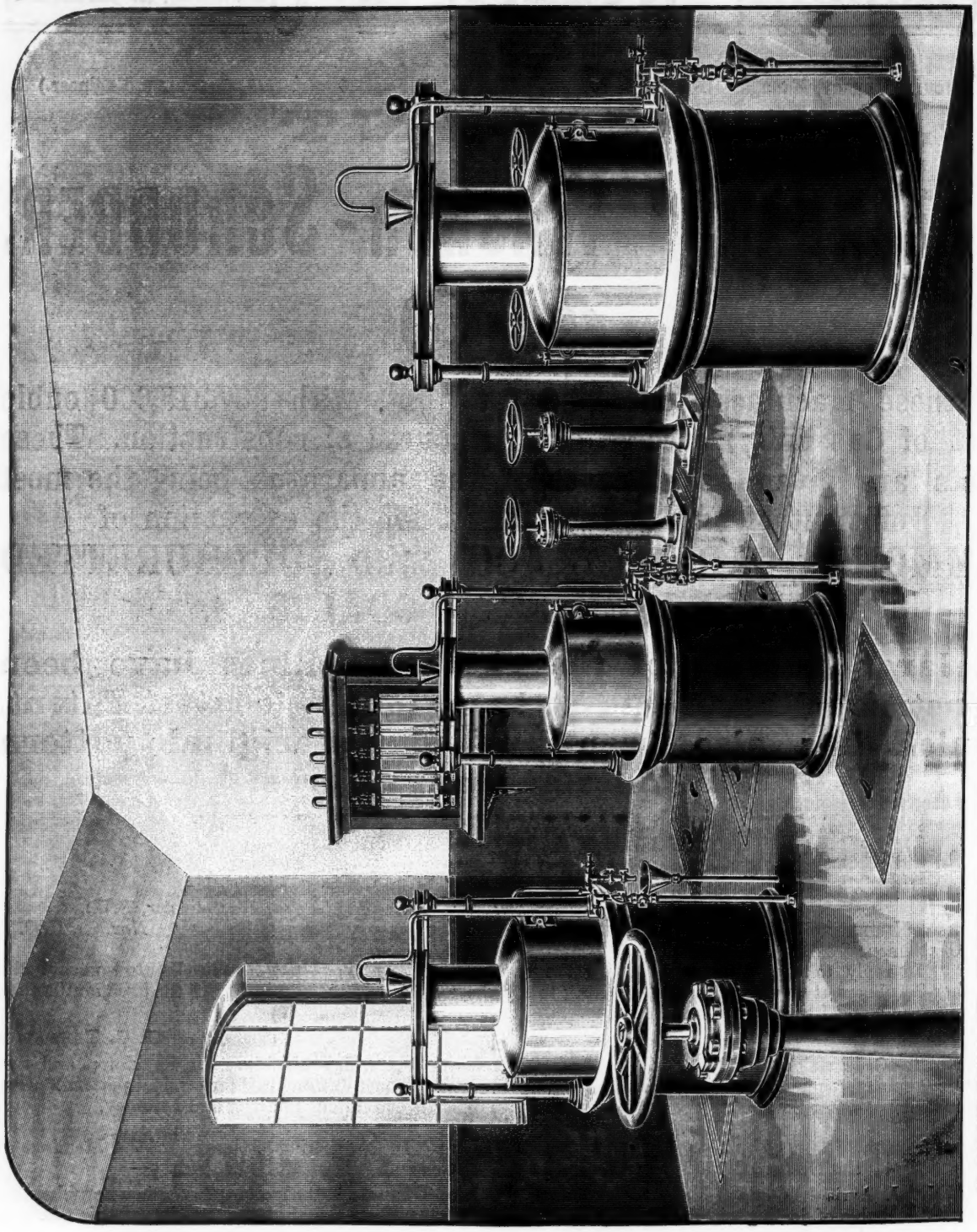

GOVERNOR-ROOM, GAS-WORKS, SUTTON, SURREY. W. Cowan's Patent Governor.

W. & B. COWAN,

ESTABLISHED 1827

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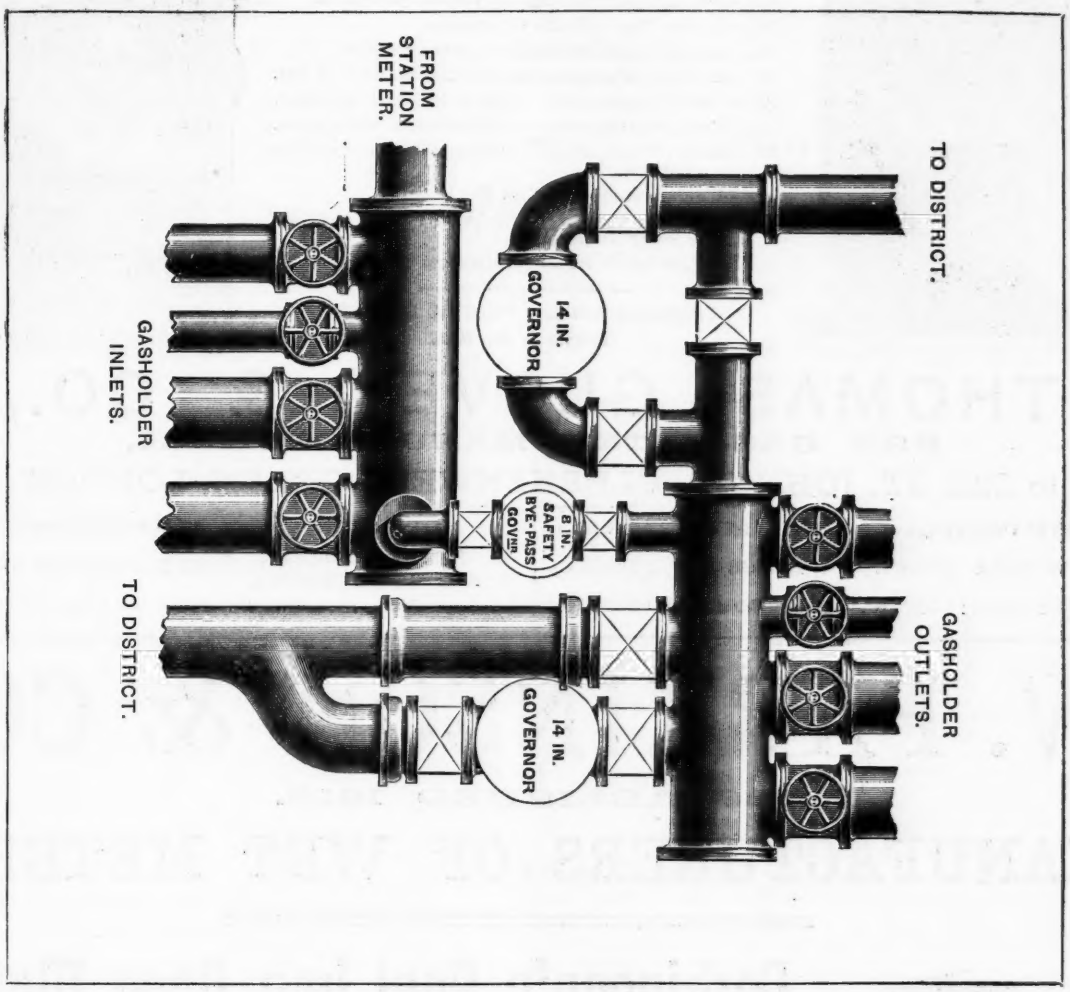
PLAN OF GOVERNORS AND BYE-PASSES

AT SUTTON (SURREY) GAS-WORKS.

FRANK MEAD, Engineer.



The above arrangement provides against the closing by mistake of Gasholder Outlet-Valve; and consequent shutting off supply to Districts. The Safety Bye-Pass Governor is placed between the inlet and outlet of Gasholders; so adjusted that it opens when pressure at outlet falls below that of lightest Gasholder.

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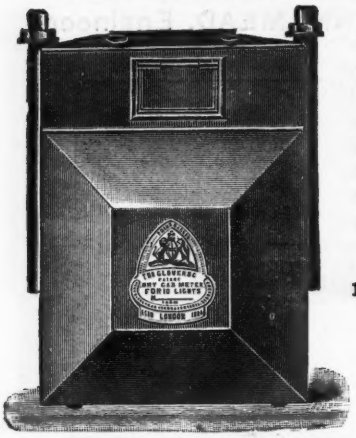
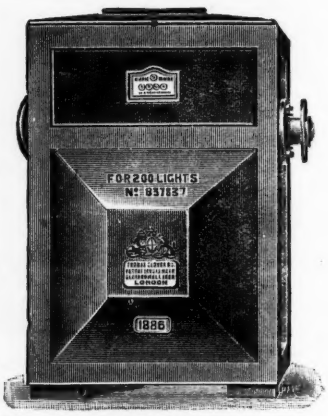


1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.



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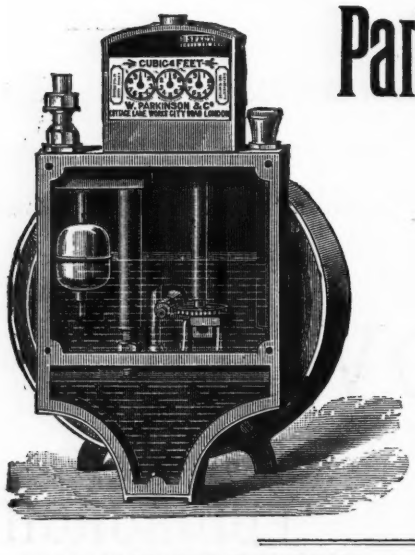
W. PARKINSON & CO.

ESTABLISHED 1816.

MANUFACTURERS OF WET METERS.



Parkinson's Cast-Iron Case Meter.

Works with very little friction.

Will stand very high pressures.

Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.

Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.

Unexcelled for Simplicity of Construction, Excellence of Workmanship, and Accuracy of Registration.

COMPENSATING METERS,

In Tinned or Cast-Iron Cases.

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, APRIL 11, 1893.

The Report and Accounts of the Commercial Gas Company.

THE report of the Directors of the Commercial Gas Company and the statement of accounts relating to the last half-year's working of the undertaking will be found in another part of the present issue of the JOURNAL; and the ordinary general meeting of the Company will be held on Thursday—the delay of a week being due to the Easter holidays. The net profit for the half year upon revenue account is £44,441; and, in order to pay the dividends recommended by the Directors, after the rate of 12½ per cent. per annum upon the old stock, and 9½ per cent. per annum upon the new stock of the Company, it will be necessary to take £710 from the reserve fund. This is, in effect, all that the Directors have to say to the proprietors. It will be observed that the present accounts show a very much better result than those published this time last year, which revealed a net profit balance of only £27,666. It appears from the revenue account that the gas-rental for the half year amounted to £138,672, with gas selling at 2s. 6d. and 2s. 9d. per 1000 cubic feet; whereas for the corresponding period of 1891, the rental was £124,946—gas being 2d. per 1000 cubic feet cheaper. Residuals, however, have again fallen; the revenue from this source being only £39,160, as against £45,898. On the other side of the account, it is shown that the expenses of gas manufacture have dropped from £125,132 to £115,296, owing to savings under the heads of coal and labour. Altogether, the working expenses show a decrease of from £146,001 to £136,522; while the Company's gross income has improved from £173,668 to £180,963. The capital has been increased, and now stands at £880,000. From the different working accounts it may be learnt that the Company have at length fallen into line with their neighbours; and from being large users of cannel have become buyers of petroleum spirit. The Company's gas output, however, instead of increasing, shows a falling off of 18,627,000 feet, or nearly 1·8 per cent. on the sale for the corresponding half of 1891, which is movement in the wrong direction, and is all in the private lighting. This is a point to which the Chairman (Mr. J. Blacket Gill) may be expected to address himself in the course of his official speech on Thursday.

A New (?) Gas.

IT must surely make a few old readers of the JOURNAL rub their eyes and pinch themselves for assurance of wakefulness, to hear that it is actually in contemplation at this time of day to start a company for exploiting in England the manufacture and sale of hydrogen, by the acid process, as a means of lighting and producing motive power. Such is, notwithstanding, the truth. We have been favoured with an early intimation that the "Hawkite" gas and the "Hawkite" gas apparatus will shortly be heard of in this character. Now, "Hawkite" gas is nothing but hydrogen; and the apparatus vaunted under the same name is merely an arrangement of a vessel in which scrap iron specially prepared is to be subjected to the action of dilute sulphuric acid with a view to the collection and utilization of the resultant gas and copperas. There is nothing either fraudulent or even mysterious about this operation in gas making. One may perhaps be strongly inclined to ask: Why "Hawkite"? But, on the other hand, one may inquire: Why "Dowson"? There is a good deal more art in the Dowson gas-making apparatus than goes to the designing of a "Hawkite" gas plant; but who is to pronounce judgment in a matter of degree like this? All that we are concerned for is to warn the investing public that any scheme for exploiting hydrogen gas or hydrogen gas plant involving the action of dilute acid upon metal must rest its claims to merit and novelty wholly on apparatus. There is no property in the process, which is as old as modern chemical science itself. It is to be expected, moreover, that the "Hawkite" scheme, if it ever comes out, will propound the old "wheeze" of getting a principal product for nothing by reason of the value of the "residuals." What this means it is hardly necessary to point out. The chief interest of the rumoured venture to us is less technical than philosophical. We are driven to inquire, in view of "Hawkite gas" schemes as of "Progressist" Social Economy, whether there exists any industrial process so stale, or any economic fallacy so exploded, as to be free from the risk of being put into some flashy new fancy dress, dubbed some proprietary name, and paraded in the light of day as a great and original discovery.

The Hull Strike.

IT is permissible, in the circumstances, to use a hackneyed phrase, and remark that "the eyes of England" have been turned upon the port of Hull during the past week, where the heads of the principal shipowning firms have been making a stand against the Dockers' Union for the right of controlling their own business; and the Union has been forced to struggle for its own existence. The origin of this latest and, in many respects, most typical of the Labour troubles that have marked the organization of dock and wharf labour according to the principles of the New Unionism, is worth telling. The facts are few, and they do not appear to be disputed. The great Hull firm of Wilson at one time were members of the Shipping Federation. This position, however, was not agreeable

to Mr. C. H. Wilson, M.P., the working head of the firm; and, after about a year's experience of it, he withdrew—declaring his confident belief that his firm could get on better by dealing directly with their own men, and independently of any amalgamation of employers. Mr. Wilson is evidently a man who has a dislike of doing things by halves; and therefore, when he decided to trust his men, he did so "all in all"—even going to the length of playing an active part in the formation of the local branch of the Dockers' Union, and taking the chair at the meeting convened by Mr. Ben Tillett at which such formation was decided upon. After this, Mr. Wilson aided the men's organization in every possible way; and he was in and among them as one of themselves. As time went on, however, it became increasingly evident that the Union leaders were disposed to be at their old games—preferring demand after demand which had nothing to do with the wages or welfare of the workers, but aimed at making the Union master of everybody and everything. Concessions upon trifling points were regarded as signs of weakness on the part of the employers, until at length the crisis arrived. On the 20th of February, three coal barges came into dock for Messrs. Wilson, manned by crews some of whom were unionists in arrears with their subscriptions, and others were not members at all. The Union leaders refused to allow these barges to be unloaded until Messrs. Wilson had themselves paid up the subscriptions in arrear, and had compelled the non-members to join the Union. They further threatened that, if Messrs. Wilson obtained other men to do the work, they would block the ship into which the coal from the barges was to be discharged. This brought about a deadlock, which lasted a fortnight, and ended in Messrs. Wilson re-joining the Shipping Federation, and, in conjunction with the other Hull firms, declaring their intention to restore and maintain freedom of employment in the port. The Union thereupon ordered a strike. The Shipping Federation replied by drafting in free labourers; and the old issue was once more joined. The result is hardly doubtful. The strikers seemed to make headway at first, under the inflammatory oratory of Tillett and J. Havelock Wilson, of the Seamen and Firemen's Union; but from the moment when the Local Authorities awoke to a proper sense of the gravity of the occasion, and procured sufficient force to keep the peace and protect those who were willing to work, the valiant agitators kept in the background, and the unionists saw their only chance of getting their own way vanish. Mr. C. H. Wilson has himself throughout been very accessible—speaking freely to the strikers, and listening to their leaders; but he has nevertheless declared that he will sooner leave the port and trade of Hull than submit to the tyranny of the Dockers' Union. In acting up to this determination, he will have the sympathy and support of every true friend of labour throughout the kingdom, which would soon be starved out if left to the tender mercies of the Tilletts and their like. We have discussed this strike elsewhere, and shall return to it next week, by which time, in all probability, the agitators who have driven the Hull employers to bay will have slunk out of the town to escape the vengeance of their dupes.

A Timely Pamphlet.

In last week's JOURNAL, we gave the principal portions of a paper by Mr. J. M. Turnbull, of Edinburgh, on "The "Comparative Cost of Gas and Electric Lighting." This paper was written for the Edinburgh Merchants' Association, which, it is hardly necessary to remark, occupies a perfectly independent position as between the gas and electric lighting industries. Mr. Turnbull's work has the merits of being perfectly candid, and of not dealing with anything but recorded facts. He addresses the consumers chiefly; but he also says something on the financial aspect of electric lighting undertakings which local authorities, who are now greatly beset by electricians' touts, would do well to hear. At the request of several subscribers, we have reprinted so much of the paper as was published in our columns. As we have over [and over again declared, the gas industry has no quarrel with those supporters of electric lighting who will only speak the truth concerning the respective claims of the two systems of artificial illumination. It is notorious, however, that certain firms of electrical contractors are "beating up" for new business throughout the country, and are devoting their attentions more particularly to local authorities whom they assume to be ignorant of the commonest data connected with the subject. Audacity is the "note" of these individuals; and they are only to be foiled by the dissemination of reliable information. It seems absurd that the elementary facts of the comparative cost of electric and gas lighting should still require to be kept before the public. But this is the truth; and while men like Mr. W. H. Preece go up and down the country supplying glozing estimates of the prospects of electric lighting enterprise for the benefit of municipalities puzzled to know what to do with their Provisional Orders, it is to be expected that obscurer men in the same trade will continue their importunity of the provincial public.

The Valuation of a Tramway.

THE terms of Sir Frederick Bramwell's award, assessing the value of certain tramways constructed under the provisions of the London Street Tramways Company's Act, 1870, in view of their being purchased by the London County Council, have attracted a good deal of attention. The valuation was governed by the terms of the Act, which exclude the idea of attaching a freehold value to the Tramways Company's property. Tramways were, in fact, the first statutory undertakings to which a limited term of enjoyment of exclusive privileges was assigned by Parliament. The wording of the particular Act now under notice, however, allowed some room for uncertainty as to the basis upon which the tramway was to be valued for transfer to the Local Authority. It was enacted that, in the event of the authority deciding to purchase the tramway after the expiration of the stated period, its value at that time should be ascertained in the usual way. The County Council, having resolved to avail themselves of the purchase clauses of the Act, held that the statutory expression the "then value" of the tramway means its structural value merely—or what is called, in the article upon "The Municipalization of Gas Supply in "America," which appeared in the JOURNAL on the 14th ult., the "cost of duplication"—subject to an allowance for depreciation. The Tramways Company, on the other hand, held that the "then value" of their property includes its value to them as a profit-earning undertaking. Sir Frederick Bramwell has decided in favour of the view of the County Council; and he has fixed the price to be paid for the property in question "exclusive of any allowance "for past or future profits of the undertaking, or any com- "pensation for compulsory purchase, or other consideration "whatever, except the consideration of the value to the "Tramways Company or to the County Council, measured "by what it would cost either the Tramways Company or "the County Council to establish the purchased tramways "if such tramways did not now exist, but taking into "account a proper deduction in respect of depreciation." The County Council, however, are directed to pay to the Company the costs of the award. It is not for us to discuss this matter here; but the facts are worthy of notice as the first authoritative statement in England of the principle that, in certain cases, the cost of duplicating a tramway, which is a statutory undertaking, is the measure of its value at a given time.

Mining Royalties.

THE systematic study of Blue-books is, happily, unheard of as a course of reading; for while it can hardly be doubted that a good deal of information might be picked up in this way, the stern facts dealt in by the official compilers of these forbidding publications would be destructive of a good many illusions, if they were generally known. Half the grievance-mongers in and out of Parliament would find their occupation gone if the public were put in effective possession of the truths that actually lie buried in the "decent obscurity" of Blue-books. We are moved to make these remarks by the appearance of the final report of the Royal Commission on Mining Royalties, which contains a great deal of valuable information relating to mines and mining that will probably be carefully left alone by those who talk most upon the subject. It has long been a stock contention of the Socialists who have exploited the British miner, that the cost of coal and other minerals is unjustifiably heightened in consequence of the charges for royalties, way-leaves, &c., which represent the "unearned increment" of landlords' profit in this connection. Accordingly, the agitation on the subject having reached a certain head, a Royal Commission was appointed, with the Earl of Northbrook as Chairman, to inquire

into it. The Commission appear to have encountered some difficulty in getting at the facts; and Mr. Pickard, M.P., President of the Miners' Federation, who has probably talked as much as anybody about the inequity of mining royalties, disappointed the Commissioners by declining to help them in this matter. It turns out that the talk about the hardship of the royalty system in regard to the mining industry is mostly sheer nonsense; and the Commissioners go as near to describing the whole idea as no more than a "mare's nest" as is permissible in a formal report of this character. The following is a short summary of the conclusions at which the Commissioners have arrived: They estimate the amount paid as royalties on coal and metals worked in the United Kingdom in 1889 at £4,665,043; and the charge for way-leaves in the same year at about £200,000. They are of opinion that the system of royalties has not interfered with the development of the mineral resources of the United Kingdom, or with the export trade in coal. They do not consider that the terms and conditions under which these payments are made are, generally speaking, such as to require interference by legislation; but they offer several practical suggestions for removing detail obstacles to the development of the mining industry, and call for the reorganization of the so-called Department of Mines at the Home Office. There appears to be a great deficiency of statistics relating to British mining, which favours the promulgation of all sorts of unfounded statements on the subject. The last observation is only too true, as everybody who has large dealings in minerals very well knows. In the coal trade, with which we are more particularly concerned, it is hardly possible to get at the truth of current statements; and the most impudent fabrications of interested parties remain uncontradicted simply because there are no authoritative data to which reference can be made. It is not so on the Continent. There everybody may know what is going on in and about the coal-fields, from the reports of officials compiled without reference to the exigencies of the market.

A Discouragement for Metric Enthusiasts.

Something was said in these columns recently about the practical difficulties that prevent the introduction of the metric or any other decimal system of weights, measures, or currency into the United Kingdom. A striking illustration of this kind of difficulty is afforded by the recent action of the American Iron and Steel Association in returning to the use of the "gross" or "long" ton of 2240 lbs. in official reports, after having used the "net," or "short" ton of 2000 lbs. since 1865. The change was made in response to the expressed wish of a majority of the members of the Association; and it is a great disappointment to the decimally-minded, who take the opportunity for raising the complaint that our irrational and confused system (or want of system) of weights and measures seems to be no nearer to improvement than ever. "There is less "and less prospect for the adoption of the metric system in "trade here as the years go by and the change becomes "more difficult." This is our own view of the subject. Analytical chemists universally employ the simple metric system in their work; and we should be the last to complain of a change from the present deceptive method of stating the degree of the purity of coal gas from sulphur compounds to a metrical expression. There is all the difference in the world, however, between the conveniences of laboratory working and the requirements of the great commerce. The chemists started with a clean slate, upon which they could figure in any notation they preferred; and as their results are so very largely the determination of ratios, it really does not matter what they call their units. But to ask the United Kingdom, the United States, and all the English-speaking world to take the plunge into the metrical system for the purposes of trade as well as scientific work in the laboratory, is a proposition as tremendous as would be a demand for a new English language constructed on what are called logical principles. This question has been raised again, we notice, by the President of the Congress of the National Union of Elementary Teachers, who has expressed his sorrow that the Chancellor of the Exchequer "poured cold water" upon the deputation that waited upon him a short time ago to advocate the change. This spokesman of the school teachers declared that he and his fellows would have much more time for instructing their pupils in other useful subjects if the metric system were to be compulsorily introduced through the schools. This is a pretty good example of rampant pedagogy, which would make everything in life subservient to the uses of the class-rooms. When it can be shown that one-half, or one-quarter of the "subjects" already taught in elementary schools are really retained by the pupils in useful shape six months after leaving school, it will be time enough to talk of dislocating the commerce of the country in order that school teachers may escape from the obligation of superintending their charges in the tedious task of getting up "the tables" by heart.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 653.)

There is not very much to chronicle by way of proceedings in the Stock Exchange during the broken portion of a week which was cut up by holidays, Christian and Jewish; but such as the record is, it is fairly satisfactory. The resumption of business was attended by a favourable tendency in most markets. The brilliant Easter weather especially affected our railways; and the Foreign and American markets presented a more healthy appearance. In fact, had it not been for the sinister reminder afforded by an Australian Bank, that "booms" frequently involve serious ultimate consequences as their cost, a considerable and general advance in prices might have been brought about. As it is, they have kept up remarkably well. Money has been in good temporary demand; but the outlook in the Market is unchanged in the main. In the Gas Market, business has been as quiet as might have been expected; and movements in value have been both few and slight. Still, such as they are, they are all in the right direction; and the general tendency is towards firmness. Among Gaslight issues, moderate business was done in "A" at steady figures—never ranging more widely than from 222 to 223½. The secured issues were in good demand, and realized such high prices as almost to lead to the expectation that the quotations would be raised. South Metropolitans were tolerably active so far as business in "B" went; and prices were steady and unchanged. A few transactions were marked in Commercial, at prices very near the top figure. The Company's accounts for the last half of 1892 show a much better state of affairs than for the first half; and the earnings are only £700 short of the amount required to provide the dividend. The Suburban and Provincial Gas Companies present no feature calling for remark; being very quiet and unchanged. The Continental undertakings alone exhibit any perceptible advance; and they are all strong. Union improved 2; and Imperial, 1. None of the undertakings in other parts of the globe are conspicuous, save that Melbourne bonds are ½ better *ex div.* Among the Water Companies, very little business was done, except in East London, which was rather weaker—falling 1. The debenture stock, however, improved to a similar extent; and Lambeth 10 per cents. did the like.

The daily operations were: Business in Gas was quiet at the opening on Tuesday; but prices of everything dealt in were good. The only change was a rise of 1 in Continental Union. Transactions were rather more extensive on Wednesday; and the general tendency again was favourable. Imperial and Union advanced 1 each. In Water, Lambeth rose 1; but East London was 1 lower. On Thursday, business fell away to very meagre proportions; and prices remained steady and unchanged. On Friday, there was a little more show of animation, with conspicuous firmness all round; but quotations still continued without any variation. Saturday offered no particular feature for remark; and the only move was a rise of 1 in East London debenture.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the City of London Electric Lighting Company—The Cost of a Semicolon—The Alternating System in America.—The Electric Lighting Experiment of the Anglo-Romano Gas Company.

The report of the Directors of the City of London Electric Lighting Company has been issued; and it shows that the expenditure on capital account up to the end of the past year amounted to £448,163. The commercial existence of the undertaking is dated as from June 30 last, previous to which time the plant was only run for the purpose of testing. The gross revenue for the six months was £10,425, against an expenditure charged to revenue account of £9991, "including the loss on the public lighting," whatever this may mean. In this way a credit balance of £434 is shown, which is a very creditable piece of bookkeeping. City people hardly need to be informed that great activity has been manifested by the Company in laying their "ways" underneath the pavements, for many miles of busy thoroughfare have been rendered impassable by these

operations during the past winter. It is stated that by the end of the present year the Company will be able to supply current throughout the City area; and then they will be in a position to test the capabilities of this unique district in the matter of electricity consumption. Conflicting rumours are afoot as to the advantages offered by the Company to their patrons. On the one hand, the lighting of the Mansion House is reported to be costing very much more than was anticipated; while individual renters of offices have been known to express surprise at the cheapness of the service. Whether this latter circumstance means that the consumption of electricity for lighting some offices is small, and consequently unprofitable, remains to be proved by the Company. It is, however, unhappily true that many offices in the City of London are so badly lighted naturally that some kind of artificial illumination is necessary all day; and in such places the Company may reasonably expect to do good business.

Persons who are unaccustomed to studying Acts of Parliament have been known to experience considerable difficulty in making out the sense of a clause, on account of the absence of punctuation. Upon inquiring after the reason of this striking omission, they are informed that it is a measure of prudence conceived in the public interest, with the object of preventing the harm that might ensue from the accidental misuse of the seemingly insignificant comma, to say nothing of the portentous semicolon. An instance of the mischief that may follow upon neglect of this precaution is supplied by an Act passed by the Legislature of the State of Connecticut in 1889 for the regulation of railroad crossings, which contains the following clause: "No electric, cable, or horse railroad shall hereafter be constructed across the tracks of a steam railroad at grade; nor shall any steam railroad cross any such electric, cable, or horse railroad at grade, except upon application and approval by the Railroad Commissioners." This clause was approved, with the semicolon in place, and duly became law. Then it was discovered that there should only have been a comma after the first sentence. The effect of the mistake is to place the electric and other tramways at a disadvantage as compared with the steam railways, which was never intended; and much costly litigation may be incurred before the matter is set right.

Mr. G. L. Addenbrooke, a well-known English electrician, has sent to the *Electrical Review* a thoughtful criticism upon the alternating current system in America. There has recently been a "convention" of electricians at St. Louis, in connection with which an authoritative paper on this system of electrical distribution was read by Mr. R. H. Sterling. In the States, as in England, there has been, and still is, much dispute between experts respecting the rival merits of the alternating and continuous systems; and it is interesting to learn the views of the subject entertained by practical American electric light purveyors, who are understood to work with a much freer hand than is granted to their congeners in this country. According to Mr. Addenbrooke's summary of Mr. Sterling's paper and the discussion upon it, the prevalent English opinion that this liberty, or license, has proved in the long run detrimental to American electric lighting practice is justified. For the sake of cheapness, the Americans adopted from the first a very high rate of alternation, and overhead wires. This is now perceived to have been a fundamental mistake. Sooner or later, electrical distribution plant will be forced underground throughout the States, as in this country; and already the electricians themselves "recognize the fact that any system of aërial conductors can never give us the safe and sure service which is necessary to enable us to compete with a satisfactory and reliable source of illumination such as gas." The passage is Americanese; but it is nevertheless intelligible. The truth appears to be that a quickly-paying business can be made in America out of supplying electric light in towns by means of overhead wires and alternating currents; and while the town authorities are content to endure the nuisance attending this system, the electricians do not greatly trouble themselves to improve the sorvice. They understand, however, that this is a temporary, catch-penny kind of trade; and they admit that when the towns adopt a more self-respecting policy, their circumstances will approach the conditions created for the United Kingdom by the Electric Lighting Acts—which, by the way, are no longer abused by British electricians.

A good deal of notice is being taken by technicians of the electric lighting department started by M. Pouchain, of the Anglo-Romano Gas Company, which has already been noticed in our columns. The electricity is generated by water power, derived from the renowned falls of Tivoli; and the plant is on the Ganz system. No harm has been done to the scenery of the neighbourhood by M. Pouchain's operations; and there is practically any amount of additional power to be had from the same source, if more should be required. The Gas Company have now had more than a year's experience of their new venture; and it would be interesting to learn whether it has answered their expectations. We venture the observation with no desire to indulge in "carping criticism;" but it would be more satisfactory if those European gas companies who have gone into the electric lighting business, and have done it very well, in the technical sense, would only be a little more candid respecting the financial results. As it is, one hears of the splendid way in which they carry out their installations, and then, to use the classical phrase, "the rest is silence."

STRIKES AND LOCK-OUTS, OLD AND NEW.

In noticing last week the report of the Labour Correspondent to the Board of Trade on "Strikes and Lock-Outs," we mentioned that, among other kinds of labour disputes, Mr. Burnett has put in a separate category those referring to the attempts on the part of trades unionists to exclude free labourers from all chance of obtaining employment. It would be easy to show that disputes arising from this cause are of far more serious import than any that are concerned with questions of the rate of wages pure and simple, although the latter may be on a larger scale, and bulk more formidably in the eye of the public. When men strike because they want sixpence for that for which their employers are only willing to pay fivepence, the difference is of a character that can generally be depended upon to settle itself in the course of time. If economic conditions favour the men, they will win; and, if not, they will lose in the long run. But, in either event, the relative positions of employers and employed remain as before. Trades unionists who strike for the exclusion of free labour, however, really aim at the effective control of the employers' business, which is just the point that the employer cannot afford to cede at any price. On the other hand, it is equally obvious that certain Trades Unions—notably those which pretend to "organize" unskilled labour—depend for their very existence upon their ability to secure and maintain for their subscribing members either the monopoly of employment or, at any rate, some preferential claim upon the sources of wages. Bearing these facts in mind, it is easy to understand that the struggles of certain classes of Trades Unions against freedom of employment can only cease with the life of the Unions themselves.

Commenting upon Mr. Burnett's admission that strikes with the object of securing the monopoly of employment usually end disastrously for the strikers, *The Times* said in a leading article, that the leaders of those Trades Unions which are most prone to embark in such desperate enterprises may be recommended to spend their days and nights in studying Mr. Burnett's figures. In pursuance of our ordinary practice of bringing before our readers instructive matter culled from abstruse and bulky publications which are not likely to come into general circulation, we give the following as a summary of what the Blue-book has to say with regard to this subject. Mr. Burnett refers to the Cardiff strike of February, 1891, as having been practically "a struggle between the Seamen and Firemen's Union and a combination, acting on behalf of the shipowners, called the Shipping Federation. The men were defeated; and a heavy blow was thus struck at the movement, which insisted upon the employment of nothing but Union labour." About the same time the Liverpool dock labourers came out on strike for a similar object, although it was thinly disguised as a demand for permission to wear Union badges. Here again the strikers "were unable to enforce their demand." Altogether, while in the year 1891 there were 47 strikes against the employment of free labour, the greatest proportion by number—51 per cent.—were entirely unsuccessful. This bare enumeration of the strikes for this particular object does not, however, give a correct idea of the facts. Mr. Burnett admits that "it is among the unsuccessful ones that much the larger proportion of persons involved is to be found." The truth is that, wherever the employers held out for the sake of the principle, they won; and that no general importance is attachable to the smaller number of cases in which, for private reasons, the employer thought fit to yield the point. It seems to be the opinion of *The Times* that workmen and their leaders have only to study these authoritative statements respecting the futility of striking against freedom of employment, and such strikes will not recur.

Yet within a few days from the appearance of Mr. Burnett's report, another dispute of the same class, which threatens to assume large proportions, has broken out at Hull. Here the Dockers' Union has hitherto been paramount; the men having had no such check as their fellows of Liverpool and Cardiff have suffered. The usual result seems to have followed. The local Union leaders have once more exemplified the wisdom of the proverb which states the consequence of putting a "beggar upon horseback," and have meddled and muddled and preferred demand after demand until—as might have been anticipated—the employers' patience has become exhausted, and they have set their hands vigorously to the task of recovering control of their own business. Mr. C. H. Wilson, M.P., the head of the great shipowning firm, met the men in his employ last week for the purpose of explaining the situation to them; and this he succeeded in doing in the clearest manner. He told the men, in the hearing of their professional leaders, how the shipowners of Hull had "come to the conclusion that it is impossible for them to carry on their business in a satisfactory manner if they are to be, as they were at present, entirely in the hands of the Dockers' Union." They have accordingly determined to support the opening of a Free Labour Exchange, and to be their own masters in the management of their own business. They intend the Labour Exchange to be kept open. They will raise no objection to any workman on account of his belonging or not belonging to a Union; but they have made up their minds that the foremen aud shipping clerks shall not belong to a Dockers' Union. These are the heads of the Hull shipowners' *ultimatum*, against which the Trade Union

leaders have declared their intention to fight to the uttermost, even to the extent of calling out the gas stokers. This latter threat is not novel; having been used often enough before, when swaggering demagogues have essayed in vain to bring about a "universal strike."

Alderman Ben Tillett is to the fore in this contest, which is probably the last stand of the Dockers' Union against the destroying forces that unfavourable conditions of trade and the hectoring of their own officials have arrayed against the organization. He has essayed to reply to Mr. Wilson's indictment of the Union; but all he can say in defence is that Mr. Wilson's charges are "trivial," and represent the shipowners' action as an attack upon the men's "constitutional right to combine." This is very lame, for the most stupid docker must see that any combination of his making which does not give him either the monopoly of, or a preferential claim to, employment would be valueless. The agitators know this well enough; but they are too prudent to say as much. Moreover, they know that, in what the Hull shipowners have set themselves to do, they will as certainly succeed as did the employers of Cardiff and Liverpool; and it will be much if the Dockers' Union survives after it has lost control of Hull.

This is the reason why the mere publication of such statistics as those given by the Labour Correspondent to the Board of Trade respecting the large proportion of failures in the total number of strikes against freedom of employment will not avail to prevent their recurrence under similar conditions. These aggressive movements are, in reality, of a defensive character, and are not the result of reasoned counsels, but of necessity, from the Trade Union point of view. Alderman Ben Tillett's idea of constitutional privilege is "everybody to do as I please." For if the Union-paid demagogue is to live by his organization, he must be an autocrat. Your modern Social Democratic agitator holds as firmly by his Divine Right to power and pay as ever did the most arrogant Bourbon of them all.

Otherwise, if knowledge really governed action, an attentive study of a certain tabular statement which forms "Appendix I." to Mr. Burnett's report, would be fruitful of great good. This is his "General List of Strikes and Lock-Outs;" showing cause, date, result, and mode of settlement so far as ascertained. The first table occupies 50 pages of the Blue-book; and the same material is further classified in various ways, so as to exhibit all the known data. One of the most noteworthy entries in this list refers to the great brickmakers' strike in the district of Cowley and West Drayton, organized by Hutchins and Thorne, on behalf of the Gas Workers' Union. This was a strike for an advance in wages of 6d. per 1000 bricks, and was successful after a struggle lasting for a period of about seventeen weeks. We have had a good many plain things to say of Thorne and Hutchins, but we never questioned either their honesty or their good faith; and it is really pleasant to be able to bear witness to the frugality with which they managed this brickmakers' strike. The incidental expenses were insignificant, although the area affected was very large, and the campaign exceptionally protracted. It is only in connection with this Cowley and West Drayton dispute that the Gas Workers come by name into Mr. Burnett's tables. The Union may have been behind one or two other strikes of smaller proportions; but it does not appear in evidence. Let it be noted that the brickmakers' demand was purely monetary. Very many of these strikes for more wages or against reductions are listed as successful; thus forming a remarkable contrast against the usual fate of the strikes for a "principle." Some of the causes assigned for the latter description of strikes read curiously enough. For example, the case of some West Bromwich puddlers, who struck unsuccessfully against the infliction of fines on certain men for neglect of duty; or the Sheffield gas-producer men, who refused to attend an engine because such work was against their Union rules; or the Dublin long-shore men, who objected to the introduction of steam-winches for discharging cargo. The instances of strikes in which dock, wharf, and waterside labour was concerned exhibit a monotonous record of failure, although there was one case, marked "indefinite," of a collier in the Regent's Canal Dock which the coal porters refused to discharge because she had a non-Union crew, and which was eventually "unloaded by another company who employed non-Union or 'free' labour." We fancy we could supply the name of this vessel, if any useful purpose might be served thereby. From the rarity of the example, however, the trouble must be regarded as sporadic.

Finally, we may ask: What is the general conclusion that suggests itself after one has perused such statements as those contained in Mr. Burnett's report, in the light of the pending struggle at Hull? Plainly, that whatever other blessings the domination of the so-called "Independent Labour Party"—the party which affect's to politically express the aspirations and principles of New Unionists, Social Democrats, Fabians, Municipal Progressists, and the rest of the genus—might confer upon this country, such a condition would extinguish the liberty which has hitherto been regarded as the most precious birthright of an Englishman. Infinite are the variations of industrial tyranny recorded, as having at least been attempted, in Mr. Burnett's tables of the causes of strikes and lock-outs in this one year 1891. At present these essays are settled by the process of "trial and error." Every alteration in the established order of working that suggests itself to either employers or employed is "tried on." If it suits, it goes ahead; while if it is misdirected it is dropped, and there is an end of it. The method is rough and costly; but it is effectual. There is talk in some quarters of the desirability of the establishment of a Government Board of Arbitration, with power to take cognizance of, and to order the settlement of, labour disputes. But are those in whose hands the conduct of the industry and commerce of the country rests at present disposed to entertain any such proposal? Administrations are notoriously open to many influences; and demagoguery is mischievous enough as it is, without the additional power that State control of industry would lend it. Strikes and lock-outs are doubtless deplorable; but there would be no improvement in putting industry under a State Board of Arbitration, which would mean the domination of a parliamentary majority.

MR. BURDETT ON THE LONDON WATER COMPANIES.*

A POINT has now been reached in the history of the Metropolitan Water Supply when, according to the calculations worked out by Mr. Burdett, it becomes possible to ascertain the final results that would have accrued from the purchase scheme of 1880. The last issue of water stock, in pursuance of that project, was to have been made in 1892, from which time the ratepayers or purchasers would have had the benefit of all increase in the net profits—in other words, as Mr. Burdett puts it, "the worst, so far as the ratepayers' interests are concerned, under Smith's scheme, is now capable of assessment." During the entire period from 1880 downwards, adding all the years together, the amount required for interest on the water stock would have exceeded the net income which has actually accrued by £871,439. Here the ratepayers appear to be gainers by the rejection of Mr. Smith's provisional bargain with the Companies. But the case assumes an entirely different aspect when we come to reckon up certain pecuniary advantages which have been sacrificed. In drawing up the balance-sheet, there are two items, in the nature of a set-off against the deficit, which have remained the same throughout, and were quoted in our review of Mr. Burdett's book last year. Under the scheme devised by Mr. Smith, the eight Companies agreed, in order to give the Water Trust funds in hand for the conduct of their business, that the interest for the half years ending December 31 and June 30, should not be paid until April 1 and October 1 in each year. The value of this concession is estimated at £193,360. The Water Trust would also have had the benefit of the capital and revenue balances in the hands of the Companies at June 30, 1880, amounting to £322,022. A third item, arising out of the rebates and the renewal fund of the West Middlesex Company, is the same as last year, amounting to £43,100. But a fourth item has grown in magnitude, and consists of the economies which would have been rendered practicable under the new arrangement. For the complete period of 12¼ years, these are reckoned at £1,176,000. The four items thus enumerated make up a total of £1,734,482—a sum which exceeds the estimated deficit of the net income compared with the interest charge by as much as £863,043. This excess therefore represents the loss incurred by the ratepayers as the result of rejecting the purchase scheme. Had not the Torrens Act of 1885 cut down the income of the Water Companies in a manner altogether unexpected, the bargain made by Mr. Smith would appear in a still more satisfactory light.

Adverse legislation has had its effect on the income of the London Water Companies. The decision of the House of Lords against the Grand Junction Company in the Dobbs case in 1883 was also hurtful, before Parliament interposed. The net income has thus been brought down in some years, while rising again in others; the fluctuations being somewhat remarkable. Mr. Smith reckoned on an annual increase of £41,000. In 1882 and 1883 the increment was larger than this; and in 1884 it exceeded £20,000. But in 1885 there was a decline of nearly £25,000, followed in 1886 by a rise of £22,667. The net income of last year compared with that for 1891 showed an increment of £38,440. But the average increment from 1882 to 1892 has been less than £12,000 per annum, which compares with an average increase of £26,465 in the annuities granted by Mr. Smith, in the shape of deferred stock, for the same period. Yet the ratepayers would have profited had they accepted the terms to which the Companies agreed. Referring to the net water-rental, we find this increasing every year, but at a very uneven rate. The rise in 1881 exceeded £66,000; while in 1885 it was only £6456. For the last four years, there has been a steady and substantial advance; the increase in 1889 being £37,632, rising to £45,765 last year. Of course, a growing population ought to create progress of this kind; while at the same time it leads to some additional outlay on capital account. As bearing on this point, Mr. Burdett gives a table by which it appears that the population of Greater London has increased by more than a million in the years between 1881 and 1891. But Greater London does not correctly represent the area supplied by the London Water Companies. General

* "Burdett's Official Intelligence for 1893." Under the sanction of the Committee of the Stock Exchange. Twelfth year. London: Spottiswoode and Co., 54, Gracechurch Street; 1893.

Scott's report to the Local Government Board shows an increase of 942,630. Nevertheless, taking the lowest estimate, the augmented population goes far to account, as Mr. Burdett intimates, for the additional expenditure on the part of the Companies since Mr. Smith made his calculations. The total capital expenditure shows an increase of £2,812,065 in the last twelve years; while the amount expended on new works from 1880 to 1892, both years inclusive, is £3,077,570. The market value of the ordinary capital, as gauged by the prices ruling for shares in the market, is shown to have increased since 1879 by nearly £6,000,000; and the market value of the undertakings by £8,642,652—equivalent to a rise of about 30 and 37 per cent. respectively in thirteen years. But it is also observed that the market value of the eight undertakings has decreased by more than £1,530,000 since Dec. 31, 1889, notwithstanding the increase of nearly £550,000 in the capital issued. This retrograde movement we may probably attribute to the agitation set on foot by the London County Council. The market value at the close of last year stood at £32,099,862. Looking forward into the parliamentary session of the present year, Mr. Burdett alludes to the General Powers Bill of the County Council, in which is a clause by which the Council seek for power "to obtain such advice and assistance, to make such investigations, and to carry on such negotiations, on any subject," as they may consider desirable in the public interest. This would be certainly opening a wide door.

Mr. Burdett concludes his chapter on the London Water Companies by a refreshing allusion to Sir Thomas Farrer. Last year Sir Thomas, zealous for the extinction of the Water Companies, ran a-tilt at Mr. Burdett's figures, pronouncing them "extremely questionable." The remark was afterwards withdrawn; but Sir T. Farrer was understood to maintain his opinion that the County Council, and not the Companies, should have possession of the water supply. In this respect, he stood opposed to Sir John Lubbock. But Mr. Burdett is now able to recognize a change of views on the part of Sir T. Farrer, as shown in the evidence given by the latter before the Labour Commission in January last. Sir Thomas is there reported to have expressed an apprehension that the Council, if in possession of the water supply, or any other great undertaking, would largely increase the charge for labour, as they had already done in the case of a comparatively small affair—that of the parks. Sir T. Farrer is described as saying that the action of the London County Council on the labour question had caused many to doubt the wisdom of transferring public undertakings to that body; and "it considerably damped his own ardour with regard to the acquisition of the water supply, so that he was almost inclined to think, with Sir John Lubbock, that the water supply should remain in the hands of the Companies." Mr. Burdett very reasonably looks upon this evidence as indicating a change in public opinion, which he thinks is now "settling down to the support of the policy of leaving the water supply in the hands of the existing Companies, which would then, however, be placed under parliamentary and Government control." We agree with Mr. Burdett till we meet with this "however." Parliament and the Government already control the Water Companies to an extent which can hardly be enlarged if the Companies are to exist at all. In regard to the change in public opinion, as to the proper or safest custodians of the water supply, Mr. Burdett is probably correct, only we are not quite sure whether Parliament is at all times to be relied upon as representative of Metropolitan interests. The House of Commons is now more than ever a political assembly, swayed by impulses not altogether conducive to a clear judgment on questions which ought to be kept outside the domain of party strife.

The New Water Supply for Paris.—We noticed last week the inauguration of the auxiliary supply of water for Paris from the sources of the River Avre; and we take the following additional particulars from the current number of the *Builder*. The first works in connection with this portion of the water service of the city were due to the late M. Couche, who succeeded M. Belgrand. On the death of the former, the work was completed by MM. Bechmann and Humblot. It involved the construction of a line about 72 kilometres in length of open conduits, and 26 kilometres of subterranean tunnels, some of them more than 70 metres below the surface of the ground. The aqueduct has a circular section 1·80 metres in diameter, with a uniform thickness of 20 centimetres of cement masonry. The valleys are crossed by means of syphons, consisting of two lines of iron pipes, each 1 metre in diameter. The reservoir at St. Cloud will be composed of three compartments, each having the capacity of 100,000 cubic metres. But only the first compartment is completed at present. Its vaults are sustained by 600 square piers. The conduit for conveying the water to Paris is constructed of steel plates, and is 1·50 metres in diameter. At the first part of its course, it is enclosed in a shell of masonry, and crosses the railway on a series of arches; it is then carried over the river, on the supports of an iron footbridge. On passing off this bridge, the conduit disappears under the Boulevard d'Auteuil; entering Paris near the gate of that name. The difference in level between the reservoir and the footbridge is 70 metres; and several fountains arranged for the opening ceremony along the route of the service-pipe gave practical illustrations of the pressure at various points.

NOTES.

The "Hawkite" Gas Process.

Under the protection of patents granted to Messrs. Hawkens and others, a process of generating hydrogen by the reaction of iron and dilute sulphuric acid has been developed, with a view to the utilization of the gas for illuminating purposes, in conjunction with the Welsbach burner, and as a source of motive power. This process is called the "Hawkite;" and it is experimentally in operation at No. 1, Bush Lane, Cannon Street. The patents cover the design of the generator, and the preparation of the iron for use in this apparatus; there being, of course, no property in the preparation of hydrogen by the acid way. The "Hawkite" generator exhibited in Bush Lane is a metallic vessel measuring 4 feet by 3 feet and 3 feet high, having internal divisions in which two charges of 1 cwt. of iron are subjected independently to the action of from 8 to 10 gallons of concentrated sulphuric acid, diluted with six times its bulk of water. The idea of the two divisions of the apparatus is to secure something like a continuous delivery of gas, although, as a matter of fact, more than one-half of the gas obtainable from a charge comes over during the first hour. The gas is slightly carburetted with ordinary petroleum before being used. The residual product of the action of the metallic iron and sulphuric acid is crystalline sulphate of iron, the value of which is supposed to go a long way in paying for the cost of the gas. The iron charge is in the form of cakes, and is made by pressing red-hot scrap, which can be galvanized if intended to be kept for any length of time or carried to any distance. The arrangement is fairly neat; but whether or not anything is likely to come of it, in view of the antiquity of the essential features of the process, is more than can be discussed here. The following quantities relating to the cost of materials, &c., are given by the manipulators of the "Hawkite" plant. From 1½ tons of concentrated acid and 1 ton of compressed wrought-iron scrap can be made 12,000 cubic feet of hydrogen gas, and 3½ tons of iron sulphate. The values of these materials will depend on the locality where the operation of gas or sulphate making is carried on.

The Conversion of Mechanical Power into Light.

An interesting illustration of the production of light by small mechanical effort is furnished by Mr. E. C. Rimington, in a description of a novel electroscope published in the *Electrician*. The writer refers to a paper entitled "Experiments in Electric and Magnetic Fields," read by himself in conjunction with Mr. Wythe Smith before the Physical Society last November, in which an experiment was given showing the illumination of an electrodeless vacuum tube rotated in a constant electric field between two charged plates. Mr. Rimington has since found that this experiment can be much more simply shown by bringing a rubbed ebonite or glass rod near to the rotating tube, when the set of double fan-shaped images of the tube will be developed nearly as brilliantly as when charged plates are employed. It is stated that an ebonite rod excited by being drawn once through a piece of dry flannel, will produce one image when held at a distance of more than a foot from the tube; thus forming an exceedingly novel kind of electroscope. The tube is made of a straight portion 5 inches long of about the bore of a spirit thermometer, terminating in two bulbs. It is made T-shaped by the outlet, where it was connected with the air-pump, and which serves as a means of attaching the tube to the motor that revolves it. "It is not, however, even necessary to employ a motor, as twiddling the tube between the finger and thumb by the T-piece, when holding it near the excited rod, enables the effect to be obtained." The illustration is an interesting one from the fact that the extra power, infinitesimally small, required to rotate the tube when in the electric field is "practically converted directly into light."

Thermal Storeage.

Professor Forbes has been developing, theoretically, the "thermal storeage" idea of Mr. Halpin, which recently occupied the attention of the engineering journals. Mr. Halpin suggested this idea as a possible means of equalizing the load upon steam-power plant only fully worked during a portion of every day. His notion is to supplement small boilers, always worked to their full capacity, by a number of plain cylinders well protected against loss of heat by radiation. In these cylinders water is to be stored at a temperature of about 400° Fahr.; and they are to be drawn upon to make up any temporary deficiency in steaming power the boilers themselves may from time to time exhibit. In this way a 10-horse power boiler, working all day, would supply a 40-horse power engine for a short spell. The principle is essentially that of a very large boiler with a very small furnace. The unfortunate part of the scheme is the great size of the supplementary or storeage cylinders, which must be very bulky. One critic says that "thermal storeage for 100-horse power for six hours is as bulky as the steam-generating plant for 1000-horse power, and must even then be helped out by the small boiler proper." Where Professor Forbes thinks the idea might be specially helpful is in the utilization of the heat of refuse-burning furnaces. Refuse destructors must work continuously; and it is just possible that, by the system of thermal storeage applied in conjunction with this kind of plant, heat may be saved which would otherwise be

wasted. Pumping water by day and driving dynamos by night occurs as a suggestion for the utilization of the heat of town refuse-burners. It is hardly necessary to remark that "thermal storeage" after the method devised by Mr. Halpin, and favoured on paper by Professor Forbes, has not yet been tried anywhere; and a variety of obvious practical objections would have to be disposed of before an extensive steam plant, working at 250 lbs. pressure, could be regarded as a safe and economical means of adapting regular firing to intermittent steaming.

Mr. Matthew Murdock, of Sheffield, has been appointed Superintendent of the Rotherham Gas-Works.

The Boring for Coal at Dover.—The work of sinking a shaft to enable the coal measures discovered on the South-Eastern Railway Company's land at Dover to be worked has been commenced. The shaft is about 17 feet in diameter. When the Board of Trade stopped the Channel Tunnel works in 1882, Mr. F. Brady, the Railway Company's Engineer, suggested that the coal question could be tested by himself with the men retained under him to maintain the tunnel works; and this was authorized. According to him, the depth of coal measures now proved at Dover is 782 feet; and the proportion of coal is 1 foot in thickness to every 48·9 feet of strata passed through. So far as can be ascertained, the coal is uniformly good, pure, and clean throughout the seams; and Mr. Brady puts the probable yield or annual output from one double-pit colliery, provided with the best modern plant and machinery, at 450,000 tons per annum. He sets the cost of working, including royalty, at 6s. 6d. per ton in the present seams, and considers that the selling price at the colliery might be taken at 7s. 3d. per ton for good, clean, and bright coal.

The Supply of Hydraulic Power in Birmingham.—In an interesting paper recently read before the members of the Mason College Engineering Society, Mr. H. Lee, M.Inst.M.E., described the Birmingham hydraulic power supply station. It appears that, though the plant has been only recently laid down, the Water Engineer of the Corporation (Mr. J. W. Gray) had for some years previously made provision for such a supply, by laying pipes suitable for a pressure of 700 to 800 lbs. per square inch in those streets of Birmingham in which macadam was being, or would shortly be, replaced by wood paving. The object of this was to avoid disturbing the wood pavement when the time came for the erection of the high-pressure water plant. The Birmingham hydraulic power station is peculiar, in that the pumps are driven by three Crossley gas-engines, one of which is of 12, and the other two each of 20 nominal horse power. The pump suctions are connected with the water-jackets of the gas-engine cylinders; and an ample circulation in them is thereby secured. The pumps worked by the smaller gas-engine have plungers 2¼ inches in diameter and 10-inch stroke; while those driven by the larger engines have plungers 3 inches in diameter and 12-inch stroke. The working pressure of the pumps in each case is 820 lbs. per square inch. The accumulators are two in number, having rams 18 inches in diameter and 20-feet stroke. The total amount of energy which can be stored by the accumulators is about 4·2 horse-power-hours. Special precautions are taken to prevent the over-pumping of the rams. One of Brotherhood's hydraulic engines is used to start the gas-engines; being worked from the pressure mains.

Inauguration of the New Gasholder at Burslem.—On the invitation of Mr. Henry Peaty, Engineer and Manager of the Longport Gas-Works, the members of the Corporation, accompanied by the Mayor and a number of Mr. Peaty's professional friends, met at Burslem last Tuesday, to inspect the new three-lift gasholder which has just been completed there on the Gadd and Mason principle. Previous to the company reaching the works, the holder had been filled with gas to its utmost capacity; while one of the other holders on the works had been emptied of gas, so as to allow of the new holder discharging its contents as rapidly as possible. Much interest was evinced by the visitors to the works at the way in which this operation was performed—not the slightest trouble being experienced throughout the entire process. Mr. Peaty, as well as Mr. T. E. Priestman (representing the makers of the holder, Messrs. R. and J. Dempster, of Newton Heath, Manchester), were heartily congratulated—both at the time and subsequently at a luncheon given by them at the North Stafford Hotel, Stoke—on the manner in which the whole of the work had been carried out. Mr. Gadd was present to explain the various details of construction. Messrs. Dempster furnish the following particulars in regard to the new holder: The cast-iron tank is 92 ft. 3 in. diameter and 20 ft. 9 in. deep. The whole of the sides have machine-faced flanges; and the tank has proved perfectly water-tight, although erected upon a somewhat uncertain site. The outer lift of the holder is 90 feet in diameter; the middle lift, 87 ft. 6 in.; the inner lift, 85 feet; and each lift has a depth of 20 feet. The cups and dips are all 18 inches deep and 9 inches wide; the crown has a rise of 4 ft. 6 in., and is supported by a strong framework of 24 main and 24 secondary bars, with the usual purlins, tension-rods, and struts. There are 12 vertical stays on each lift, and each lift is guided by 12 spiral guides and 12 sets of rollers made in accordance with the requirements of the patent.

COMMUNICATED ARTICLES.

OXIDE OF IRON: A MONOGRAPH.

By John T. Sheard, F.C.S.

(*Continued from p.* 588.)

The Comparative Efficiency of Anhydrous and Hydrated Oxide.

As regards the chemical affinity of ferric oxide for sulphuretted hydrogen, it is not a matter of absolute importance whether the oxide exists in the anhydrous or the hydrated condition. The commonly received opinion, that oxide must be hydrated to be active for sulphuretted hydrogen, is not borne out by facts. On the contrary, both anhydrous and hydrated oxides possess the property in a marked degree;* the former being sometimes much more active than the latter, though generally the contrary is the case. The value of the material for the purification of gas appears to depend chiefly upon some peculiarity of molecular construction, not yet understood,† and in no inconsiderable degree upon the physical condition in which it is presented to the gas. For example, ferric oxide, hydrated and anhydrous, when finely powdered, dried, and exposed to sulphuretted hydrogen in U-tubes, took up sulphur as follows:—

Hydrated oxide . . . . 7·01 per cent.
Anhydrous oxide . . . . 3·26 „

The same oxide, after being suitably prepared, by grinding it with water, drying, and subsequent careful breaking up of the mass, so as to obtain the material in a granulated condition, absorbed as follows:—

Hydrated oxide . . . . 12·78 per cent.
Anhydrous oxide . . . . 11·58 „

The importance of presenting the oxide to the gas in suitable condition to facilitate the chemical reaction required was recognized by Hills; for, as already noted in his specification of 1849, he first prepared his oxide in a finely-divided state, and then absorbed it in some suitable "porous or absorbent material." In subsequent patents he claimed using the oxide "in a granular state," and also mixing lime with oxide of iron "for the purpose of dividing and exposing the said oxide to the gas." And it may be said that this has ever since been the chief aim, while it has presented the greatest difficulty to the maker of artificial oxide for gas-purifying—namely, to produce his material in a sufficiently divided, and at the same time permeable, form. Doubtless the secret of the superiority of good native oxide (or bog ore) to most artificial oxides lies also in this, that the operations of Nature have succeeded more perfectly than man's artificial expedients in producing a light, porous material through which the active ingredient is distributed in minute subdivision. As was pointed out by Eastwood (*loc. cit.*), the office of the vegetable fibre, which bulks so largely in the composition of bog ore, is twofold. First, it promoted the deposition of the oxide over a large extent of surface, when precipitating out of its original solution; and now it lightens the whole mass—making it porous and permeable to the gas. "The presence of this fine organic fibre," he continues, "has been too much regarded as a mark of inferiority rather than one of the principal agents in presenting oxide of iron, in a fine state of division, to the gas in the best manner."

And it must further be remarked that the very hydration of the oxide produces, in itself, in a very efficient degree, this state

* This was, I find, distinctly asserted by Lewis Thompson in his "Chemistry of Gas Lighting"—the most valuable work ever produced on the subject of which it treats, and still, after more than thirty years, a veritable storehouse of suggestive facts. But as there is considerable misapprehension on this matter (and I confess that I had myself, up to quite recently, accepted the prevailing opinion, confirmed as it is by "King's Treatise"), the following experiments and illustrations may serve to support the statement in the text:

(1) Some brown hematite (ferric hydrate), containing, after being dried at 212° Fahr., water equivalent to a composition of Fe_2O_3, H_2O, was reduced to powder, and exposed to the action of sulphuretted hydrogen. Another portion of the material was strongly ignited in a crucible—thus driving off all its water of hydration; the dehydrated oxide, after cooling, being exposed to sulphuretted hydrogen under exactly similar conditions to the other. The following are the results obtained:—

Hydrated oxide absorbed 12·8 per cent. of sulphur.
Anhydrous oxide „ 11·6 „ „

(2) When an oxide in use for gas purification fires spontaneously, as occasionally happens, through intensity of chemical action, its temperature is raised high enough to drive off the water of hydration, thus necessarily making anhydrous the formerly hydrated oxide. Were the anhydrous form inactive, the oxide would thereby be rendered quite useless for the purpose of gas purification; but though this may sometimes be the case, it is not generally so. On the contrary, the oxide sometimes works better after firing than before.

(3) The experience of Mr. George Anderson may be cited, who, at the time when spent oxide was valueless commercially, burnt off the sulphur therein contained by roasting the material at a red heat; and the residue, after being mixed with sawdust and watered, was again brought into use for the purification of gas. This process was repeated over and over again; the anhydrous oxide being just as effective, after the first or second time of re-entering the purifier (a peculiarity generally noticed in the case of new oxides, even when hydrated), as the original unburnt material. (*See* JOURNAL, Vol. XXX., p. 869.)

† "It is quite certain that the activity really depends neither upon hydration nor dehydration, but is connected with a peculiar molecular arrangement, rather mechanical than chemical in its nature."—*Lewis Thompson (op. cit.).*

"Ferric oxide exists in two forms, one active and the other inactive.—*Lewis T. Wright.*

of perfect division. The supreme importance of this was early perceived by Laming; and its bearing upon the subject under discussion is thus clearly described in a patent taken out by him, in conjunction with Smith, in 1860: "It is well known that hydrated oxides, generally speaking, are more susceptible of chemical action than such as are anhydrous; and that fact has suggested a prevalent belief that hydration of the oxides is the necessary condition of their chemical activity. But," they, on the contrary, assert, "the cause of great chemical energy in oxides is a condition of perfect separation between their molecules, or minute particles, however produced, and which condition hydration is only one among other means of establishing; for when mechanical water is carried down with a precipitated oxide, it confers upon it a greater volume than the water of hydration alone would give it, and at the same time makes it more chemically energetic." They had also observed "that when care had been taken to keep the molecules, or minute particles, of an anhydrous oxide from coalescing from the moment of its formation, its chemical activity is sometimes greater than that of hydrated oxides whose molecules, or particles, have had nothing solid between them to prevent their coalescing into a compact mass." The effect of hydration in breaking up an otherwise dense material, and producing a greatly increased extent of surface, is very forcibly shown in the case of lime, where the addition of water to the anhydrous oxide causes the latter to swell and break up into a bulky mass of extremely fine powder, which is the hydrate. Although the mode of bringing it about is different, the result, in the case of ferric hydrate, is doubtless the same; and so we are enabled to understand why the hydrated oxide of iron is more readily prepared in a suitable form for gas purification than is the anhydrous oxide. The one requisite for a successful purifying material—a state of fine division—is in the precipitated hydrate already produced; and there only remains to absorb or diffuse it through a suitable medium, in order to produce a porous and permeable material presenting a large extent of surface of the active ingredient to the gas.

Preparing Oxide for the Purifier.

To prepare oxide of iron in the most effective condition for the purifier, it must be treated very differently to lime. With lime, the object should be to make it carry as much moisture as possible; with oxide, to carry as litttle. A limit is imposed to both by the physical condition produced in the material by excess in either direction. Thus, if too much water be added to lime, it will agglutinate as mortar, and offer a prohibitive resistance to the gas; if too little be added to oxide, the material will be too powdery, and run through the grids. We have therefore this simple rule for our guidance: Moisten the oxide so much as, and no more than, will agglomerate its friable powder into a light, granular condition, and enable it to hold together on the grids.

Just as combustion cannot take place between perfectly dry gases, so it may be that the presence of hygroscopic water, if only in infinitesimal quantity, is required to promote the mutual reaction of sulphuretted hydrogen and oxide of iron; and, judging from observations in certain experiments I have made, I am led to think that such is the case. Generally speaking, however, it may be said that the less moisture an oxide contains, the more efficient will it be. The inactivity of new oxide, on its first application in the purifiers, is generally due to the excess of moisture it contains; which should be eliminated to some extent by drying. Under ordinary circumstances, it is not possible, were it desirable (which, from what has been said, it is not) to obtain and apply the oxide absolutely deprived of moisture.

The following experiments may be cited to illustrate the effect of an excess of moisture: Samples of the same oxide, which had been dried in an oven at 200° Fahr., were submitted to the action of sulphuretted hydrogen in U-tubes; one sample being exposed to the atmosphere for a few minutes, while the other was saturated with water. The following results were obtained:—

Dry oxide absorbed	21·5	per cent. of sulphur
Moist oxide "	12·8	" "

calculated on the dry material.

Mr. Lewis T. Wright gives as a rule for the economical employment of oxide, that it should contain 10 to 20 per cent. of moisture.* Mr. W. R. Chester states that he has obtained the highest efficiency with oxide containing only 4 per cent. of moisture.† As already remarked, it depends altogether upon the physical characteristics of any particular oxide, as to how much water should be added to it. One sample may be so absorbent of water that it will take up from 25 to 30 per cent. of moisture, and still be as permeable, and in as favourable condition for employment in the purification of gas, as another sample containing only one-fourth of this amount. If, now, these two samples be treated with an equal quantity of water, the effect on their respective purifying capacity may differ very much. Other things being equal, however, the less moisture it contains, the more efficient will the oxide generally be.

It is usual to add sawdust to new oxide, in preparing it for the purifier; but this should be regulated by the activity of the particular oxide, as well as by its physical character. A proportion of sawdust, or other light, inert material, is sometimes required to moderate the intense activity of the oxide during the early period of its use, as well as to make the mass lighter, and more permeable to the gas. But, generally, it may be said that the less of extraneous matter added the better; because as the material becomes older, and not so active as at the first, it is likely to be the more efficient the less inert matter it contains. For such inert matter (which, it must not be forgotten, is continually being added to by the sulphur deposited), by diluting the material, and separating and removing the particles of the active ingredient—ferric oxide—farther from each other, hinders the attainment and prevents the maintenance of the elevated temperature which, as will be shown, is needful for the fullest propagation of the chemical reaction desired. To moderate the excessive activity of new oxide, it should be used at first in very thin layers only; and the fouled oxide should be well watered, immediately on opening the purifier, before removal.

(To be continued.)

* Thorpe's "Applied Chemistry," Vol. II., art. "Coal Gas."
† See JOURNAL, Vol. LIX., p. 1223.

COAL GAS: ITS MANUFACTURE, DISTRIBUTION, AND CONSUMPTION.

A Series of Articles for Gas Students.

(Continued from p. 589.)

Works' Mains, Valves, Etc.

This subject, although somewhat beyond the range of observation of the generality of gas students, is important; and upon the efficiency of the connecting mains, and the necessary attention periodically given to them, will largely depend the successful working of the various portions of the plant.

The hydraulic main, which is now usually constructed in sections, requires to be cleaned periodically when the retorts are "off" for repairs, as also the H-pipes, valves, and other fittings. The same remark need not apply to the foul main, when it is of large sectional area. This main is laid with a slow fall, which may be continuous or (more generally) in sections, at the lowest point of which a drop-pipe carries down such tar and aqueous matter as may have been condensed in the main. These pipes should not be connected directly with the underground tar and liquor wells, but are best carried into seal-pots. The liquor overflow of these pots, communicating with the wells, is from 30 inches to 4 feet, as the case may be, above the bottom of the drop-pipe; thus giving it a seal of the depth named. From the outlet of the condenser onwards, the mains are chiefly below the yard level of the works. *Every pipe is laid with a slight fall;* and at the various lowest points (originally fixed and arranged by the designing engineer) large syphon-pots are provided, into which drain all the products of condensation in the mains, and from which they must be withdrawn. *It is highly essential that the periodical emptying of these syphons should be rigidly observed;* otherwise the mains will soon become water-logged. At many points of the works, this will have to be done daily, and possibly several times in the course of 24 hours. The special positions on the works where the syphons will be most required are near the exhauster, the washer and scrubber, and the purifiers, as at these points a very large quantity of liquid will be raised every day. The various forms of syphons and their connections will be dealt with in the articles upon "Distribution." The connections comprised between the inlet and outlet of the series of purifiers are usually provided with a number of manholes and cover-plates bolted on, to afford facilities for the thorough inspection and cleaning of the pipes. This requires to be done periodically, to prevent any undue accumulation of solid matter, and the consequent risk of stoppages. Similar provision is made at other points in the works.

The condensers, washer, and scrubbers are all provided with tar and liquor overflow-pipes. These must be "sealed," as already described, before having access to the wells. Dangers from gases carried down by the liquors are thereby much lessened, in addition to which, the various overflows are much more open to cleaning and inspection than they would be if carried down into the wells direct. The tar and liquor are in many works separated by a special contrivance termed a "Separator." This may consist of a cast-iron tank, divided into three portions by two vertical diaphragms—the one dividing off the tar section passing down nearly to the bottom of the tank, and upwards to above the liquor overflow; the other dividing off the liquor section, the overflow of which is above that of the tar. The two liquids separate themselves by their varying specific gravities; and the respective outlets—kept perfectly distinct by the diaphragms—are connected, the one to the tar-well, the other to the liquor-well.

Bye-pass connections are provided to most of the apparatus on the works, by which they may be shut off when required, and the gas bye-passed direct. This is effected by a main which connects both inlet and outlet pipes; valves being fixed on all three. When the apparatus is in use, the valve on the bye-pass is closed; those on the inlet and outlet being open. When the apparatus is to be shut off, the first-mentioned valve is opened, and the two latter are then closed. By using one of Anderson's four-way valves,* the arrangement is simplified, and only the one valve is required.

* See JOURNAL, Vol. LX., p. 902.

Station meters are often provided with hydraulic valves and bye-pass; the two former being placed on the inlet and outlet pipes. The bye-pass comprises a connecting-pipe between the inlet and the outlet below the valves, and a deep chamber into which it enters on either side. From the top to near the bottom of this chamber is a dividing diaphragm. When the bye-pass is closed, this chamber is filled with water nearly up to the level of the bye-pass pipe; the diaphragm being thereby effectually sealed. When it is required to throw the meter out of action, this chamber is emptied of water, and the gas flows quietly through it by the space below the bottom of the diaphragm, and thus from the inlet to the outlet pipes of the meter. The meter-valves can then be closed.

Gas-Valves.

There are in use many forms of gas-valves employed on the works' mains, &c. Chiefly, they are either hydraulic or slide valves. The principle of the former will be best indicated by a brief description of one of its simplest forms. This consists of an outer vertical cylinder, through the bottom of which the inlet-pipe rises to the level of the outlet; the latter being fixed horizontally 2 feet or more above the bottom of the cylinder. The inlet forms with the cylinder an annular space of the height named. Working in and over this space is an inverted cup or holder, to which is suitably attached a vertical spindle, passing through a stuffing-box on the top of the valve; a rack and pinion (slow screw and hand-wheel, or other means) being attached to the spindle, whereby the holder may be raised or lowered at will. The annular space is filled with water. If the holder is down and immersed in the water, it is obvious that the inlet-pipe must be sealed, and that no gas can pass. Therefore, to open the valve, the holder is raised by the spindle till it is out of the water, when gas can readily pass direct from the inlet to the outlet pipe fixed on the outer cylinder of the valve.

Disc or slide valves may likewise be worked direct by rack and pinion or by a slow screw and hand-wheel. For use with gas, the former is the better. As the name of the valve implies, it is opened or closed by the movement of a disc, which slides across or away from the gas-way as required. The valve comprises a gas-way which is concurrent with that of the main on which the valve is fixed, and a side receptacle or chamber into which the disc slides when the valve is open. In valves of the best construction, the pinion wheel actuating the rack at the back of the slide is also internally contained; the spindle of the pinion wheel alone being brought outside the valve-case through a gland. The portion of the valve against which the disc slides is truly planed and faced; and the disc is kept against the face by a strong spring, wedge, or other device for keeping it gas-tight. The valve is so placed that the pressure of gas will be at the back of the disc. The actuating spindle is sometimes connected to an upright spindle, which passes through an ornamental column; thus affording ready access to the valve, and at a height convenient to the workmen, as well as giving to the appliance a somewhat imposing appearance. Indicators arranged in various ways, enable the engineer to observe at a glance the relative position of the valve-disc.

All valves should be periodically oiled, and also turned as often as circumstances permit. This is to ensure their always being in good working order, in case of emergency. The packing of the glands will also require attention at times.

Throttle-valves and flap-valves are used in connection with the exhauster bye-pass. Their construction, however, is necessarily such as to render absolute tightness almost impossible; and hence they are but little used in any other connection.

The Theoretical Yield of a Watershed.—The yield of water in a particular watershed is necessarily a very uncertain quantity. This has lately been demonstrated by Captain J. L. Lusk, of the United States Engineers, who has computed the discharge from the Rock Creek Valley, at Washington, by a number of different formulæ. He finds that the M'Math formula gives a discharge of 25,640 cubic feet a second; the O'Connell formula, 4707 cubic feet; the Fanning formula, 7477 cubic feet; the Dredge formula, 12,771 cubic feet; the Craig formula, 21,098 cubic feet; and the Dickens formula, 21,472 cubic feet. In using all these formulæ, the area was taken as 49,363·2 acres, the length of watershed as 22 miles, and its average width as 3·51 miles; and the coefficient N of the Craig formula as 1·95.

Automatic Sulphate Plant.—In addition to an automatic conveyor and elevator plant to handle the anthracene, The Gas-light and Coke Company have ordered from the New Conveyor Company, Limited, an arrangement of elevators and conveyors for the Beckton works, to raise and distribute the sulphate automatically over the storeage-sheds. The elevator is of the tray-bucket design; and the buckets, as well as all the troughs of the conveyors, are made of wood, as the sulphate eats iron away quickly. The plant is arranged so that the sulphate falls directly into the elevator, which lifts it to the conveyors. These are carried from the beams under the roof, and are fitted with cut-off doors to trim the material all over the floors to any height. The machinery is arranged to carry out a complete automatic system, as devised by Mr. Wilton, the Superintendent of the products works.

TECHNICAL RECORD.

GAS-WORKS AS CENTRAL STATIONS FOR THE SUPPLY OF LIGHT, HEAT, AND POWER.

By Herr W. von Oechelhaeuser, of Dessau.

(*Concluded from p.* 593.)

Central Stations for the Supply of Light.

If gas-works not only possess the technical possibilities of contributing to the supply of heat and power in towns, but are also in an eminently favourable position economically for this purpose, then, as regards the supply of light, the question has been again seriously propounded as to whether these works have, in general, any chance of competing in the future with electricity as light-supplying centres. Now, the author thinks the experience of recent years has so far solved the question by supplying evidence of a steady and increasing development in all methods of lighting collaterally; and if there remain a residuum of doubt as regards illumination by gas, then within a short time the last ground for this will be removed by the use of the new Welsbach light. Gas lighting has entered a new epoch of its development with the discovery of Dr. Auer von Welsbach, of Vienna; and indeed there is, in a manner, a partial fulfilment of the wish of those who unselfishly advise us to confine ourselves to the supply of heating gas, since the foundation of the new gas-light is the perfectly non-luminous and the simply heat-giving Bunsen flame, which is employed in most cooking and heating apparatus. The incandescence of the flame is superseded by rendering a foreign body—a new "wick"—incandescent.

The author could not here enter in detail into the earlier history of incandescent gas-burners, or into the numerous suggested methods and means of application which have already been published, but could only point out specially that this first promising step in a new direction follows exactly the lines of the well-known scientific researches on the radiation of light and heat made by Wiedemann, Helmholtz, Julius, Langley, Very, &c., and according to which one ought to strive to change as much heat-energy as possible into light, and avoid the development of invisible and troublesome radiation of heat. Light without heat, or as far as possible without it, is the new line upon which the gas industry has entered with success. That there is plenty of scope for us in this new line is evident from the calculations of Langley, which have shown that, in the old gas-burners hitherto in use, as much as 99 per cent. of the energy present is rendered useless for lighting purposes. The glow-worm, with its pale green light, is to a certain extent the ideal illumination in accordance with these views, inasmuch as Langley states that it is the cheapest light without heat in Nature, and indeed is produced with a consumption of energy amounting to only 1-400th part of that consumed in a candle-flame. If, therefore, the white or somewhat greenish colour of the Welsbach light is even not agreeable to all, yet its colour alone indicates to us the right way that will lead us to the light of the glow-worm—to light without heat.

The author said: Without going further into the construction of the burner and the incandescent material, let me indicate the nature of the discovery in the discoverer's own words, as expressed in an address delivered six years ago in Vienna:—

> In all incandescent systems, it was necessary, on account of the slight emittive power of the substances employed, to select media much better than the Bunsen flame; and this had the drawback of entailing many auxiliary appliances for the equipment of any such burner, and the great simplicity of the ordinary gas-light could not be displaced by such a complicated system. Hence, either the air itself had to be forced in under pressure, or the air and gas had to be heated beforehand—that is to say, from a technical point of view, very considerably heated—in order to raise the temperature of the flame sufficiently high to enable such slightly emittive substances as zirconia or magnesia to radiate powerful light. In the newly introduced water gas, we have a form of gas which, when burnt in a suitable manner, gives a sufficiently hot flame to retain the substances referred to in brilliant incandescence, without any of these accessories. And a point of great moment is that all these systems, with the exception of those utilizing water-gas, experiments with which are not yet complete, were not economical enough to supplant even temporarily ordinary coal gas illumination. I have not encountered any of the inconveniences of these systems in my experiments. The principal failing hitherto is in the emittive power and the resistibility of the material rendered incandescent by heating in the flame. Great emittive power is required in order that the material may be maintained at a white heat in a flame of less heat than a blowpipe flame; in fact, in the Bunsen flame: great resistibility is requisite in order that it may remain many hundred hours in that condition. This leads me to speak on the most important part of my discovery. . . Hitherto one would not have dreamt of using those materials which are the principal ingredients of the incandescent substance. They are the characteristic constituents of certain minerals occurring mostly in high northern latitudes. In spite of the accurate development of the methods of separation which I discovered in the course of my scientific labours on this subject, they have to change their form many hundred times before they are obtained in the pure state in which alone they can find application on the incandescent material. When I started these researches many years ago, in the chemical laboratory of the University of Vienna, I did not suppose that the discovery which I have just had the honour of demonstrating to you would be one of the results.

Incidentally, let it be understood that the Welsbach light does not owe its origin to the competition of electric light, but to accidental discoveries in the course of pure scientific studies

which were originally mainly directed to the utilization of water gas. The fact, however, has arisen that the Welsbach incandescent material is not suitable for water gas, because its power of emitting light is very quickly reduced by chemical combinations. All gas experts have from the very beginning asserted that the new discovery presents quite a number of practical defects, and, indeed, the well-known Austrian gas engineer General-Director Fähndrich has lately summed them up so thoroughly at the meeting of gas people in Kiel,* that scarcely anything more remains to be done in this direction. However this may be, there is the fact that, in spite of these defects, the new light makes rapid progress, irrespective of the bad state of trade everywhere, even in small towns, where the primary high cost of installation would be taken well into consideration. This fact shows that the advantages of the new light already exceed its shortcomings, and that at least a saving in gas consumption can be effected by it.

The three most important advantages of the new light—viz., greater luminosity, diminished consumption of gas, and considerable reduction of heat—stand in the most intimate relation to one another. The decrease in heat owing to the smaller gas consumption alone is very great, and may be approximately estimated in the following manner: The ordinary so-called 16-candle illuminating gas gives, on an average, 5400 kilo-calories per cubic metre; consequently, 100 litres of this gas, consumed in a Welsbach burner, develops about 540 heat-units. But it may now be assumed that, as a result of the higher illuminating effect, a greater quantity of heat is changed into light, and therefore that the quantity of heat which disappears must be greater than that corresponding to the smaller consumption of gas. But up to the present there are no numerical data upon this point. Now, as an ordinary gas-flame of 16-candle power develops about 900 calories, a Welsbach burner of 50-candle power, with about 540 calories, gives only two-thirds of the heat of an old gaslight of 16-candle power; or if this luminosity of 16-candles be taken as the basis of comparison, only about 170 calories are developed, and therefore about *one-fifth* of the heat previously associated with 16-candle light. According to Renk, an electric glow lamp of 16-candles develops 46 calories. Therefore, a 16-candle Welsbach light gives only 3½ times the heat of the electric incandescent light; whereas hitherto a gas-light of 16-candle power has produced nearly 20 times the heat. *A diminution of the heat as compared with electric light from 20 times to only 3½ times, is, in practice, tantamount to light without heat.* Thus in a room a rise of temperature cannot generally be perceived at a distance of from 20 to 30 inches from a Welsbach lamp. *The products of combustion have naturally diminished with the quantity of heat to one-fifth of that previously produced for the same luminosity; and besides that the combustion of the gas is so complete that formation of soot is quite out of the question.*

One may occasionally read in newspapers that the minute particles of magnesia dust emitted from Welsbach lights exert a disagreeable action on the respiratory organs, and make looking-glasses and window-panes rough. These assertions are, however, mere romances; for there is not a trace of magnesia in the Welsbach burner. They may probably arise from some confusion of the Fahnjelm water-gas incandescent light with the Welsbach. Dr. Auer says in his address, with reference to the volatilization of the material: "Although the incandescing material suffers in itself no alteration by exposure in the flame, and therefore neither volatilizes nor fuses, yet after many hundreds of hours incandescence there is a small falling off in the light, which arises from the non-combustible particles suspended in ordinary atmospheric air, attaching themselves to the incandescent mantle, and affecting the lighting effect, even if only slightly." This statement has been confirmed in every respect; and as a further counterblast to the above assertions, there stands out prominently the interesting and, to gas experts, very gratifying fact that the glass chimneys of Welsbach lamps do not so frequently become marked, and so remain clear longer than on lamps of older pattern. Indeed, with the Welsbach light, even "Marien glass" chimneys (of sparry gypsum), which ordinarily soon become dull, remain clear in the vicinity of the light-zone; and as the superior qualities of this kind of glass absorb only a small proportion of light, they can be used to advantage in all cases where occasional flying of the chimney is anticipated.

With reference to the colour of the Welsbach light, the discoverer says: "As regards the character of the light which the glowing material is capable of emitting, it must be stated that *any kind of light, varying from the dazzling whiteness of daylight to the golden glow of the electric incandescent light, can be produced with equal facility*, by merely modifying slightly the composition of the fluid, by the admixture of a small quantity of another substance." Yellow Welsbach light is, to a certain extent, in use in Vienna at the present time. As, however, the manufacture of the special material cannot keep pace with the demand, German consumers will have still to wait some time for this improvement. In the meanwhile, pink (rose coloured) cylinders or ground-glass globes are at hand for giving the desired minor tone to the light.

As regards the effect of this powerful source of light on the eye, when compared with the incandescent electric light, it is found that in the Welsbach light as at present constructed the mantle has a superficial area of about 2000 square millimetres; and assuming 60 candles as the highest luminosity, there is a luminous surface of 33 square millimetres per candle; whereas in the incandescent electric light, according to Bernstein,* the corresponding glowing surface of the carbon filament is about 4 square centimetres. Consequently, the eye receives the same luminosity in the Welsbach light from a surface of eight times the extent, which renders the assimilation of the light-effect easier. Many restaurants and cafés have, on this account, been lighted up entirely with unprotected Welsbach lights. In any case, it is not more necessary to tone down the Welsbach light than the incandescent electric lamp.

Without enlarging at this stage on the fragile character of the material of the mantle, the author summarizes the results which have so far been obtained in some experiments made by the German Continental Gas Company in Dessau, principally to ascertain *the stability of the mantle material as regards the duration of both its cohesive and light-emitting qualities.* First of all, experiments were made to determine what was the greatest luminosity to be obtained from Dessau gas under different pressures, inasmuch as there is a definite relationship between pressure, consumption of gas, and luminosity, which should be settled, as well as the heating power of the gas, for each town separately; in fact, too high a consumption of gas may even result in diminished brilliancy. These tests repay any gas-works well for the small trouble they give. With this object in view, any number of different nozzles can be arranged for respective pressures. For example, taking the pressures 20, 25, 30, and 40 millimeters, four nozzles would suffice; and each would represent a definite consumption—say, for example, 100, 110, 120, and 130 litres. Therefore, there would be, in all, 16 different Welsbach lights to test photometrically, so as to obtain an average of four readings for each pressure and consumption recorded. The tests with Dessau gas, with a heating power of 5200 to 5600 kilo-calories, showed that the best effect—74 Hefner light-units—was obtained with a consumption of 110 litres at a pressure of 40 millimetres; whereas an ordinary batswing burner, consuming 150 litres, gave, on an average, 13·5 Hefner units. Hence, with Dessau gas, and by the use of Welsbach burners of Berlin make, a *fivefold* value is obtained from the gas.

In order to test the character of the mantle material as regards *durability* and *light-emission*, a preliminary experiment was made with six Welsbach lights, three of which were obtained from Vienna, and three from Berlin. In six experiments, one of each of these burners was used under similar pressures; the three pressures employed being respectively 40, 30, and 20 millimetres. The consumption in all six experiments was 110 litres. At 20 millimetres pressure, the utilization of the gas was imperfect, although the Vienna burner gave 45 candles, even at a pressure of 10 millimetres. The photometric measurements were made on the new photometer of the State Physico-Technical Institute with the Hefner standard light. In the thirty measurements made up to date, each burner was subjected on each occasion to twofold extinction and relighting; making for each burner a repetition of these operations at least sixty times. Moreover, the burners were repeatedly carried from place to place. The removal and resetting of the burners, and also the carrying about from one room into another, demonstrate that the new mantle material is already somewhat more tenacious than the earlier compositions, and, on the other hand, no reducing influence on the illuminating effect could be established in connection with the sixty extinctions and relightings. Of course, this does not indicate that the requirements of practice have yet been attained. Nevertheless, it led *to the making of observations on the quality of the light-emitting substance, the so-called "fluid."*

A very important influence on the illuminating effect is exerted by the form which the mantle is caused to assume when prepared for use; and it appears to be unquestionably *more advantageous to have the mantle fitting tightly round the burner, and retaining its cylindrical shape as far up as possible.* It is further of importance to have an opening of at least the size of a pea in the upper part of the mantle, so that the gaseous products of combustion do not accumulate too much therein. It must be noted that both the Vienna and the Berlin mantles were used on the excellent Bunsen burners of Julius Pintsch, of Berlin, which are also regarded as the best in Vienna. Therefore, all the mantles were tried on the same burners and with the same gas.

At the end of last September, after the six burners had been going for 1500 hours, eight others, in two lots of four each, were taken indiscriminately from those ordinarily supplied to the Dessau Gas-Works by the Incandescent Gaslight Company; and at the time of publishing these experiments, each lot had burnt respectively 900 and 500 hours. These new series of experiments gave astonishingly favourable results as regards constancy of light-emission, about which more is said below.

To avoid the destruction of the mantle by the fracture of the chimneys, Marien glass was employed; but the ordinary glass chimneys were used for photometric measurements. With the same object in view, thin wire gauze could with advantage be placed over the ordinary glass chimney to a height of about 6¾ inches. In the following table, the average results for three kinds of burners are shown. The Vienna and Berlin burners No. I, were worked at a pressure of 20, 30, and 40 millimetres; and all the new burners No. II. at 40 millimetres. Besides this, the measurements are arranged together in the table.

* *Journal für Gasbeleuchtung*, 1892, p. 527.

* "Conversion of Electric Current into Light," p. 20. Hamburg; 1891.

Duration of Burning.	Electric Incandescent Light at 110 Volts Pressure. (See Note.)						Incandescent Gas Light—Consumption 10 Litres per Hour.						
	Luminosity in Hefner Units.				Mean Luminosity in Candles.	Percentage Reduction.	Luminosity in Hefner Units.				Mean Values of Berlin Burners Nos. 1 and 2		Percentage Reduction of Luminosity in Berlin Burner No. 2.
	Group I.	Group II.	Group III.	Mean.			Vienna Burner.*	Berlin Burner No. 1.*	Berlin Burner No. 2.*	Mean of Berlin Burner.	In Candles.	Percentage Reduction of Luminosity.	
Initial illuminating power .	17·0	18·5	16·8	17·4	15·0	..	74·8	55·0	61·6	58·3	50·2	..	..
Average of 500 hours . .	15·3	15·5	13·7	14·8	12·7	..	62·6	43·8	57·1	50·4	43·4	..	..
After 500 hours	13·6	13·0	10·6	12·4	10·7	28·7	48·0	36·3	54·0	45·2	38·9	22·4	12·4
Average of 800 hours . .	13·5	13·9	12·5	13·3	11·4	..	56·3	40·5	..	41·0	35·3	..	..
After 800 hours	12·5	10·2	9·5	10·7	9·2	38·5	43·3	32·7	..	32·7	28·1	43·9	16·3

* The pressure in the Vienna and Berlin No. 1 burners was from 20 to 40 mm.; that in the Berlin burner No. 2 was 40 mm.

Note.—A comparison is furnished by the investigations on the duration of electric incandescent light, recently communicated by Professor Thomas and Messrs. Martin and Hasler to the American Institute of Electrical Engineers. A collection of 127 lamps, nominally of 16 candles, from various makers, showed an average initial luminosity of 15 English candles; and after 1000 hours an average of 8½ English candles. The reduction in luminosity after 1000 hours therefore amounted to 43½ per cent. of the initial illuminating power. The average efficiency of the so-called 16-candle incandescent lamps for 1000 hours amounted to 11 candles, or 30 per cent. less than the nominal candle power of 16 candles—1 candle = 1·023 German union candle (N.K.); while the average consumption of energy during the 1000 hours amounted to 61·6 watts. (See JOURNAL OF GAS LIGHTING, July 26, 1892.)

The consumption of energy by the electric incandescent lamps averaged at the commencement 48·4 watts; and after 800 hours, 46·2 watts. A German normal candle equals 1·162 Hefner units.

The results of these experiments are, *inter alia*, the following:

(1) The duration of the period of burning with all the six burners of the first series of experiments was astonishing; for even after 2400 hours' observation it had not terminated.

(2) The reduction of illuminating power after 500 hours was much slower than has hitherto been assumed; and after about 1300 hours, in the case of the Berlin burners of the first series of experiments, even increased again. Indeed, it was also observed, in other quite old and disused mantles, that, when parts thereof were exposed to the rapid currents of air in the cylinder along its inner side, these portions glowed with renewed brilliancy—a further evidence of the almost inexhaustible lighting power of the Welsbach mantles.

(3) As anticipated, *the luminosity increased with the pressure. Hence for all data relating to the luminosity of incandescent gas-lights, it is indispensable that the pressure, as well as the consumption and heating power of the gas, should always be mentioned in the same way as the voltage is given in connection with electric incandescent lights.* With the Berlin burners, the initial luminosity increased 26 per cent., and with the Vienna burners 30 per cent., by a rise in pressure from 20 to 40 millimetres; so that for every additional millimetre of pressure the luminosity increased about a candle.

(4) Contrary to the view, hitherto entertained, that a higher pressure shortens the life of a Welsbach light, it is demonstrated that, for the same consumption of gas, and within limits of pressure suitable for ordinary application, from 20 to 40 millimetres, *there is a slower decline in luminosity at the higher pressures. Higher pressure may therefore be employed for increasing the luminosity without shortening the life of the mantle.* This does not confirm opinions which have been expressed on this matter up to date from well-informed authorities. Meanwhile, it is quite possible, and even probable, that the durability would be reduced by raising the pressure above 40 millimetres, which is already regarded as high in practice.

(5) The variation between the Vienna and Berlin burners, and also the results of the series of experiments with the last eight Berlin burners, show distinctly that the manufacture of mantles is making rapid progress; and there is exhibited in the last series of experiments (Berlin burner No. II. in the table) a reduction of luminosity which is quite astonishingly small.

(6) The chief economical result, as regards gas consumption, deducible from the foregoing table, is that the Berlin burners have given a mean luminosity of 50·4 Hefner units with Dessau gas during 500 hours. In an ordinary open batswing burner, 110 litres of the same gas give only 10 Hefner units. *Therefore during 500 hours the gas was utilized on an average to a five-fold better effect by the use of the Welsbach light than in an open batswing burner.* Moreover, even in the very best regenerative burners, gas has only been utilized to the extent of 2 to 2½ times. By the employment of a Welsbach light instead of a 16-candle batswing burner, a saving of 160 — 110 = 50 litres, or 30 per cent., is effected, and, in addition, three times the quantity of light is obtained. Or if the mean course generally adopted in practice is taken, of obtaining more light as economically as possible—for instance, replacing two ordinary open lights by one Welsbach—there is a saving of 320 — 110 = 210 litres, or 66 per cent., and a luminosity of 50 instead of 32 candles, consequently 1½ times as much light.

If, then, gas makers regard this impending diminution in the consumption of gas without anxiety for the future, it is evident that, at the Berlin price for 16-candle gas, 16 candles of Welsbach light costs only about 100th of a shilling, including all cost of maintenance. Therefore it has not only outgrown the competition of electric incandescent light from central stations by selling at an average of about one-fourth the cost, but has also even attained the cheapness of petroleum lighting. In fact, even surpassed it in Germany, where at the present time petroleum lamps cost 0·01 to 0·014 of a shilling per 16 candles illumination; and this without reckoning the cost of maintenance. As petroleum has always offered a more powerful competition to gas than electricity, we may reckon on restitution from this direction also. *The demand for "more light" can, therefore, in the future, be satisfied in the cheapest way by gas.*

It now devolved upon us to study, in our Dessau electrical central station, the length of life and the reduction in lighting power of electric incandescent lamps in the same way as we had done with the Welsbach gas-light. This was all the more necessary because the fact that electric incandescent lamps fall off considerably in illuminating power with time, has for a long while ceased to be a secret to the public. I would, however, have desisted from publishing any comparative experiments here, if many similar experiments had not recently been communicated to various journals. I, therefore, considered I ought not to keep from you these direct comparisons.

We obtained, from four German incandescent lamp manufacturers who were known to us as the best, incandescent lamps of nominal 16-candle power, and requiring 3 watts at a pressure of 110 volts. Five lamps of each make were taken; and the 20 were mounted on a common support. The whole of the lamps were supplied from a battery of twelve Tudor accumulators; and consequently the risk of getting up too high a pressure, which would act destructively on the lamps, was obviated. The pressure therefore fluctuated only between 109 and 110 volts; and the lamps were always tested at 110 volts—in fact, at the pressure for which they were constructed. The so-called 16-candle incandescent lamps were selected because they are the ordinary type of lamp employed in Germany; and incandescent lights of higher illuminating power are comparatively very seldom met with in practice. Nevertheless, in order to make the comparison even as regards illuminating power on an approximately equal basis with the Welsbach lights, we carried out experiments later on with incandescent lamps of nominally 50-candle power. The results of our comparison of electric and gas incandescent lights are as follows.

(1) All electric and gas incandescent lights differ from one another, even with the same voltage or pressure of gas, as the case may be. These differences are not greater, in proportion to the illuminating power, in the case of Welsbach lights than with electric incandescent lamps.*

(2) Out of the 14 Welsbach lights which have up to the present time been used in experiments during 2400 or 800 and 500 hours, only three mantles have come to grief after 1170, 1950, and 2340 hours respectively. Out of 20 electrical glow-lamps, 8 burnt through in from 59 to 533 hours. Moreover, out of 10 electric lamps, 4 burnt up immediately on placing them in position, on account of short-circuiting in the lamp itself; and they were replaced directly. The 5 lamps of one make (Group IV. in the table) had burnt out within 150 hours; and consequently we were obliged to disregard their performance when calculating the means and making up the table. In practice, however, the flying of the chimney and the fracture of the mantle would, indeed, anyhow be considerably greater than in our experiment. It appears, however, to be fully compensated for on the other side, in the burning up and short-circuiting of electrical incandescent lamps.

(3) The durability of the electric lamp filament and the Welsbach mantle could not, up to the time of publication, be compared beyond 800 hours, because the experiments with the electric glow lamps were only commenced subsequently. At

* According to experiments made by Ch. Haubtmann (*L'Electricien*, Sept. 24, 1892), the following numbers were obtained from ten sorts of lamps from different countries (nominally 16-candle with 102 volts):—

Initial illuminating power	15·00—21·00 can
Nominal " " after 1000 hours .	5·08—14·98 "
Average " " " " " .	8·50—16·00
Average life	600—1800 hou

any rate, out of six Welsbach lights, four have reached a period of burning amounting to 2400 hours. The Berlin Welsbach lights subsequently set going have, up to the present time, burnt 800 and 500 hours respectively; and the electric lamps record 800 hours of burning.

(4) There is not a great difference, as regards the falling off in illuminating power, between the Welsbach light and the electric glow lamp, if the mean values for both, in the series of experiments marked Berlin Burner No. 1 and No. 2 respectively, are compared. The Welsbach light, after 500 hours, is 6·3 per cent. lower; after 800 hours, 4·5 per cent. higher. If, however, the last deliveries from Berlin, in September, 1892, are taken into consideration, then the mantles of the Welsbach lights are observed to diminish in luminosity only half as quickly as the filaments of the electric glow light.*

The average luminosity during 500 hours was—

	Hefner Units.	Candles.
Electric incandescent light	14·8 ..	12·7
Welsbach light	50·4 ..	43·4
„ „ (latest supply) . . .	57·1 ..	50·0

With Dessau gas, therefore, Welsbach light is, on the basis of an average of 500 hours, three to four times as bright as good 16-candle electric incandescent lamps of commerce.

Moreover, the Welsbach light appears to be well *suited for street lighting* when burnt in wind and dust proof lanterns; and, by means of a small permanent flame, it can be either lit or extinguished by simply turning a tap. Under such conditions, the glass chimneys remain remarkably clean. However, before these lights can be introduced on a large scale, we must wait for the 100-candle lamps which are actually being constructed, and meanwhile use up to 400 candles, as was the case before the intense burners of Siemens, Wenham, Butzke, Schülke, and others. Anyhow, as General-Director Fähnrich stated at the recent meeting of gas experts at Kiel, it is now only "a question of time for Welsbach lights to be employed, as a source of light for very powerful illumination, of 300, 500, and even more candles;" and then comparisons can be made also with the electric arc lamps.

There would be no object in introducing here a general comparison of the relative cost of gas and electric lighting. However, taking into consideration the average numbers found in our Dessau experiments, and comparing the *initial* illuminating power of a 50-candle electric glow lamp (without making any allowance for deterioration) with the *average* illuminating power during 500 hours of a Welsbach light, and with the Welsbach light considering the maintenance charges of the Incandescent Gas Light Company as well as the local period of burning of 700 hours, then according to the rates ruling in Berlin, it follows that electric light in that city is at the present time about four times as dear as the Welsbach light.† Hence the gas industry is entering on quite a new development even as a source of light. Moreover, the Welsbach light has furnished the simplest solution to yet another question—one which was referred to by different partisans as the "burning question of the day" even at the meeting of gas people in Strasburg in 1891—namely, the problem of raising the illuminating power of gas by impregnation with heavy hydrocarbons.

The manufacture of a heating gas, for consumption in Welsbach burners, of better quality than that which can be prepared from good gas coal, probably means simply introducing a difficulty, and would be unreasonable. On the contrary, it may sooner be expected that those gas-works which still make gas of specially high illuminating value will revert to the normal illuminating, heating, and power gas of 5200 to 5600 calories per cubic metre. As an indication of this, the largest London Gas Company has discontinued the supply of a specially high illuminating gas in a part of London hitherto served with it, and are now delivering only ordinary 16-candle gas, though they have experimentally proved that they could produce, from water gas, gas with any degree of luminosity, easily and without any technical difficulties.

* Director Salzenberg has written from Bremen that they have yielded 64 Hefner units with a consumption of 90 litres of gas under 36 millimetres pressure. With one burner no diminution of light was observed after 400 hours; while the light had only fallen to 59 Hefner units, or only about 8 per cent., after 740 hours' burning. So, too, one of the most recent lamps tested at Dessau burnt 238 hours without showing any decrease in illumination. These are, of course, exceptional cases; but they indicate a possibility of such permanent light.

† Cost of 600 Hours' Burning Per Annum.

A.—*Electric Incandescent Light.*

(1) For three incandescent lamps of 16 candles at 3·6 pfg.—

	Marks.
600 hours, at 10·8 pfg.	64·8
Three lamps, at 5 marks . . .	15·0
Total	79·8
Or 13·3 pfg. per hour.	

(2) For one incandescent lamp of 50 candles—

	Marks.
600 hours, at 11·25 pfg. . . .	67·50
One lamp	5·00
Total	72·50
Or 12·08 pfg. per hour.	

B.—*Welsbach Light.*

	Marks.
600 hours, averaging 100 litres (at variable pressure), gas at 16 pfg. per cubic metre	9·60
12 months' subscription for maintenance, at 60 pfg.	7·20
Four supplementary mantles (two or three are provided for accidental injury)	1·60
Total	18·40
Or 3·07 pfg. per hour.	

But even this gas of 16 English candle power cannot be obtained without the use of some of the richer and dearer kinds of cannel coal, &c., which are constantly becoming scarcer. Thus Professor Vivian B. Lewes, of London, in his excellent Murdoch Lecture,* justly advocated the manufacture of gas of only 14 English candle power without any such addition of supplementary coal, especially as its illuminating power could be considerably increased by the selection of suitable burners, and, moreover, it could be furnished at a lower price.

Therefore on this point also, except where local conditions make a higher luminosity desirable, we find both force of scientific facts and the experience of gas engineers deciding in favour of those who persisted in having an illuminating power which depends on a natural basis—the ordinary gas coal—and not on the scarcer and dearer cannel, or the still more expensive carburetting materials.

The cursory glance here thrown over the wide field of the coal-gas industry points, in the author's opinion, to the following conclusions:—

(1) Accessible facts have shattered the accusation that the gas industry failed to make important progress before the introduction of electric light.

(2) Manufacturers of illuminating gas have not neglected or impeded the introduction of water gas, either on account of inactivity or through the abuse of a presumed monopoly, but by reason of a thorough knowledge and the necessary consideration of the economical conditions, which are questions of primary importance in this case. When these economical conditions and other circumstances affecting gas making—such as customs duties, labour troubles, &c.—alter in favour of the production of water gas, manufacturers of coal gas will be found at hand quite ready to go forward.

(3) So also the manufacture of a non-luminous heating gas has hitherto only resulted in failure; and in Germany, up to the present time, it has no chance of even a moderately economical success by the side of the existing coal gas of higher heating value. The supplanting of all existing heating arrangements is a chimera which must, among other things, succumb to the increased cost of the distribution of gas of lower heating value, and to the considerable expenditure attached to meeting demands due to great variations of temperature. This finds support, *inter alia*, in the experience hitherto gained in America.

(4) Coal gas, at the present prices, is already an economical fuel, even for use from a central supply station. The purposes to which illuminating gas can be applied for heating and cooking are very much more numerous and extensive than is generally supposed. Good and effective appliances for heating and cooking in kitchen and house are now to be had in great numbers, and of manifold patterns, from many reliable firms.

(5) Again, where gas is still too dear for heating purposes on a large scale, and presumably will always remain so (for the distribution of all artificial heat from a central station seems quite out of the question), gas coke furnishes a fuel of high heating value, which can eliminate part of the smoke nuisance of towns, and can be delivered to the consumer cheaper by horse and cart than it could be in the gaseous form.

(6) Coal gas is exceptionally adapted for the central distribution of power. The existence of gas-engines to the extent of about 70,000-horse power in Germany alone is a proof of this. In two years, at least 10,000-horse power was connected with the gas-mains.

(7) Towns and their suburbs and neighbouring towns can be provided with fuel for power by means of gas-mains to any extent required. The internal combustion in gas-engines, as opposed to the external heating of steam-boilers, ensures an increasing advantage for gas-engines in the near future. The size of gas-engines is growing rapidly; and single or double cylinder engines up to 500-horse power can safely be counted upon in the next few years. Hence all conditions favour a power supply.

(8) The cost of the equipment for the storeage and distribution of power by gas, as well as losses in mains and by conveyance of gas, are extraordinarily small.

(9) The gas industry has entered into a new phase of its development since the appearance of the improved Welsbach light, by which also the carburetting question is annihilated so far as it touches the production of a gas of higher illuminating power than the so-called 16-candle gas.

(10) The cost of the new incandescent gas-lamp makes it at present the cheapest of all modes of illumination by single lights up to 65 to 70 light-units, not only when compared with electric light, but also when contrasted with lamps burning mineral oil, in Germany.

And now a word or two in conclusion. It seems to have become quite a fashionable mania in technical literature to throw into the distant future, ingenious glances which are mingled as

* See Journal, Vol. LIX., p. 1177.

slightly as possible with the knowledge of scientific facts, and to predict technical and scientific revolutions which involve the certain overthrow of at least one of the older industries. It would, therefore, perhaps even in Germany, be opportune to take to heart the advice given by Professor Emerson Reynolds, President of the Society of Chemical Industry, who, when referring recently to this treatment of technical problems, said it would be opportune "to take short views," and therefore better to direct attention for once to matters nearer at hand. Those who are far-sighted are known to see badly things that are near. In fact, as is so often urged, but always in vain, the step which has to be made from the technical to the economical success is at least quite as difficult as that from the first inception of a discovery to its assumption of a technically useful form. Take, for example, the highly interesting transmission of power, to the extent of about 200-horse power, from Lauffen to Frankfort, a distance of about 175 kilometres, for the success of which even gas people had expressed sincere good wishes to the individuals and firms interested. It is unhesitatingly to be regarded as a technical triumph; but yet it is, in itself, no economical success, when one considers the money expended for the transmission of this quantity of power. And, as far as I know, this has not, up to now, been claimed for it, even by the directors of the undertaking. Then, again, further evidence that the transmission of power over long distances and in great quantities has not yet met with an economical solution, is furnished in the communication which Professor Riedler made in the *Zeitschrift des Vereins Deutscher Ingenieure* (1892, p. 1319, *et seq.*), in reference to the result of the competition for conducting 125,000-horse power from the Niagara Falls to Buffalo. The distance in this case does not amount to one-fifth of that between Lauffen and Frankfort; being only 32 kilometres. The cost of laying down and working the so-called cheap natural power becomes so great as soon as it has to be transmitted considerable distances and in really large quantities, that, in the case in question, the owners of the water-power—an industrial company—propose to temporarily relinquish the industries for which the power was required, and to put them up in the neighbourhood of Niagara, so as to use the water power direct in preference to increasing the cost of this power by numerous transformations and distant transmission, to such an extent that nobody could pay for it in Buffalo, or would pay for it in competition with other sources of power. So when the mountain will not go to the prophet, the prophet goes to the mountain. And in this projected cataract town there is not even to be a turbine central station; but, according to Riedler, the company will sell, not power, but water, and offer opportunities for obtaining power by outflow conduits, so that every factory will have to provide its own water motor. "At present there is nothing further said about transmission of power to Buffalo. Experiments in such transmission will only be made in course of time, and then not merely technically, but also commercially, but not designed in any way in connection with the first great undertaking, and not on the imposing scale for the elaboration of which the original scheme was arranged. This is a true perception of the commercial and also the technical conditions which mark the moderate staff of the undertaking as keen men of business, and not as enthusiasts of some transmission problem. For the present, this acquaintance with a designed, carefully arranged, and extensive transmission will therefore be withheld from the technical world; and this mighty enterprise will not pay any money out for gaining experience in this interesting question of power transmission, but will provide a vast water-power station. . . . Every transformation of power would be in this case an interesting, costly, and circuitous expedient."

In the gas industry, we go to work in quite the same simple and cheap manner, since we deliver to our consumers, not power, but fuel for power, and in the most suitable form for combustion—the gaseous form. Moreover, it passes through the mains under the smallest possible head of pressure, and at the cheapest rate conceivable for transport; and it is then left to everybody to choose for himself the best gas motor, with internal combustion. In this simple, and on that account but slightly interesting manner, gas engineers have, for the last 22 years, as we have seen, transmitted and distributed, with perfect commercial success, sufficient gas to furnish about 120,000-horse power over a distance of about 13 kilometres through duplicate cast-iron mains. *Nevertheless we protest emphatically against having any desire to be the general purveyors of light, heat, and power distribution.* We are fully in accord with the moderate leaders of the electro-technical movement, and our friends in this industry, who have repeatedly expressed the view that, even in the future, petroleum, gas, and electricity will retain collaterally unimpaired their commercial values and their characteristic markets. Only to those Hotspurs who never get tired of prophesying a speedy "world's decline" to our industry we assert—referring them to facts quoted—that the gas industry stands not merely on two, but even on three legs, healthy to the cores—viz., *Light, Heat, and Power.*

A Petroleum Exhibition in the Netherlands.—An exhibition of petroleum and its uses for heating, lighting, and motive power, is to be held at Bolsward, in the Netherlands, from July 19 to Aug. 11 next.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The Annual Meeting in Boston.

(*Concluded from p.* 546.)

Mr. H. A. Allyn, of Cambridge (Mass.), read a paper entitled "Effects of the Trolley System on Gas and Water Pipes." The trolley system is an arrangement for working electric passenger cars by the aid of current generated at central stations. This is conveyed by overhead wires to the cars; and the rails act as the return, or negative. The difficulty appears to be that this return current occasionally utilizes the gas, water, or other conduits for the purpose of making short cuts back to the generators, in which case effects similar to the wasting of the negative pole in a galvanic battery are produced. No harm is done where the current enters, but at the point of exit there is much corrosion and pitting; or sometimes a current will attempt to cross a comparatively poor conductor, when heating results. At Cambridge, a telephone company were the first to suffer. As a remedy, the superintendent of wires for the city (Mr. C. H. Morse) suggested larger copper wires under the rails. Some of $\frac{8}{8}$ inch diameter were accordingly laid down, with satisfactory results. Then considerable trouble arose with the water-pipes. All kinds of protective measures were tried—galvanized, rustless, tar-coated pipes, &c.—but without effect. Sometimes new pipes were destroyed in a month. Once, in laying a main, the packing took fire; and the main layer received such shocks that he resorted to wooden tools to drive in the yarn. Two water supplies were connected by a copper wire, and they became too hot to handle. Mr. Morse had suggested joining up all pipes with copper wires at intervals throughout the city; but, on being informed that the gas-pipes were laid with cement joints, he withdrew this suggestion. It was singular that only one gas-pipe—a 1¼-inch service—had been attacked. The author exhibited several samples of injured pipes, and said he considered the matter of sufficient importance to call for the special attention of the Association. Mr. W. R. Addicks, of Boston, had forwarded him particulars of several cases of injury to pipes in that city from a similar cause.

In the course of the discussion, Mr. Nettleton said that, while his pipes had escaped, the telephone wires had not; and his men had received shocks. The cause was the defective connections of the rails; and the difficulty ceased when these were carefully joined to make contact. Mr. Stiness said he had had some experience with electric cars. A good deal of electricity leaked into the ground at the basement of the generator building. He had seen an escape of gas ignited by the sparks on an electric trolley; and this was an important item to be considered. A car passing over a road where there was a broken main was not a pleasant thing to contemplate. He understood that the difficulty could be remedied; and therefore he hoped it would receive the careful consideration of the meeting. Mr. C. F. Spaulding produced some samples of injured pipes. He said he thought the nature of the soil had something to do with it, and that a coating of non-conducting material would be a good remedy. Other members gave instances of injury to pipes caused by escaping electricity. Mr. Allyn replied at some length to various questions. He said he considered the water-pipes showed the injury soonest, on account of the pressure inside them, by which a weak place would be found in less time than in a gas-pipe. He only had these troubles in the streets where the cars ran. With regard to the jointing of the rails, branch wires were carried from each rail to a central copper wire.

A paper entitled "Pressure Registration Mains and Services" was contributed by Mr. S. J. Fowler, of Springfield (Mass.), and illustrated by pressure diagrams and a map of the district. He commenced by exhibiting a registering pressure-gauge, fitted for taking diagrams extending over a week, as a specimen of the appliance used for obtaining the results referred to. The district concerned was next described; the chief feature being that it consists of two levels more than 100 feet apart. The principal lines of main and centres of consumption were indicated. The annual consumption is 80 millions; the largest main, 16 inches. The governor is only used in the daytime; the full pressure of the holders being put on the district at night. The diagrams showed that the day pressure was 20-10ths; and the evening pressure, 35-10ths. In times of heavy consumption, the pressure on the high level was much less than that at the works; but at ordinary times it was about 14-10ths higher. The author claimed to have illustrated the importance of taking pressure diagrams throughout the district.

The President (Mr. W. A. Wood) invited a very full discussion, as the majority of gas companies were satisfied with the pressure indicated at the works, leaving the various parts of the district to take care of themselves. A little work with an ordinary pressure-gauge would, he said, surprise many, even if there were no complaint. Mr. Coggeshall said he had found a diminution of pressure, supposed to be due to increased consumption, to be really caused by accumulation of hoar-frost in the pipe. Mr. Nettleton remarked that he had used a 24-hour registering-gauge, but considered the 7-day one a great improvement. Mr. Lamson observed that the greater the rate of consumption, the greater would be the amount of friction in the mains. In pumping gas through trunk mains, a considerable loss of pressure from this cause would be observed, though not even a

single burner was supplied. Mr. Willard thought some of the difficulty mentioned in the paper might be due to small branch pipes from the principal lines of main. Sometimes the latter were enlarged, and the branches left untouched. Mr. Prichard agreed with Mr. Lamson that the loss by friction was much greater than that shown in published tables. He had found the loss on about 1000 feet of 20-inch main, which, according to calculation should be only 2-10ths, to be actually 10-10ths. The loss of pressure through service-pipes and meters was, he thought, much greater than was generally supposed.

A communication from Mr. E. C. Jones, of San Francisco, dealing with every-day pyrometry, was read by the Secretary. For ascertaining the comparative heats of retorts, &c., this gentleman uses a little tin box, 4 inches long, having a round hole at either end, and 20 small squares of evenly-flashed blue glass, each of which can be pushed into range of vision, or withdrawn, as may be desired, by a wire attached to it. It is used by standing 10 feet from the surface to be tested, and viewing it through the whole of the twenty glasses, which are to be withdrawn one by one, till the light emitted by the red-hot surface becomes visible. Thus, if six were moved back to get the desired effect, fourteen would remain. By this means, one retort or furnace can be compared with another. He has also tried the metal pyrometer, as used in Germany. This consists of a series of twenty-seven metals and alloys, fusing at different temperatures. Beginning with cadmium, which melts at 600° Fahr., zinc comes next, then alloys of silver and copper, silver and gold, gold and platinum, and pure platinum, which fuses at 3227°. These are supplied in strips; and as a fragment the size of a pin's head is sufficient for each test, they last a long time. After trying different receptacles, a small round saucer of porcelain was found to be best suited for standing in the retort, &c. To take a test, fragments of alloys are placed in the saucer, and exposed in the retort or flue for ten minutes. The colour gives a rough indication of the number on the scale of alloys to use. This apparatus is both cheap and very portable, as the whole can readily be carried in the pocket. These alloys, used in connection with the blue-glass photo-pyrometer, enable useful working results to be obtained. The latter may be rated to some extent by the former. He had made many experiments; and the results showed that the actual temperature in retorts and furnaces was lower than was usually supposed.

After the reading of the paper, Mr. Pritchard exhibited a photo-pyrometer sent by the writer. The metallic alloy system of measurement, he said, was certainly good, as compared with other methods proposed. It involved only one source of error, and that was the purity of the alloy. Methods depending upon specific heat must necessarily be doubtful. Mr. Greenough described at length the plan of taking temperatures by exposing a piece of iron of known weight to the heat to be tested, cooling in water, and noting the rise of temperature acquired by the water. He had carried out a lot of tests by this method; and he thought it as reliable as those described in the paper. His results were somewhat at variance with those obtained by Mr. Jones, as they supported the general opinion. Mr. M'Kay, after referring to the air pyrometer and Regnault's mercury pyrometer, said that at the Sèvres porcelain works in France they used a set of non-metallic alloys—consisting of quartz, marble, and clay—that were gauged about 50° apart. A pyrometer dependent upon polarization had recently been introduced in France. Some metallic alloys sent by Mr. Jones were handed to Mr. M'Kay for experiment; and Mr. Greenough suggested he should compare that system with the iron-block plan.

Mr. C. D. Sherman, of New Haven (Conn.), read a paper on "The Removal of Carbon from Retorts without the Use of the Steam-Jet." He had discarded steam in favour of air compressed to 40 lbs.—*i.e.*, the same pressure as the steam, This method was not new, as it was used, he said, by Mr. T. N. Kirkham at the Imperial Gas-Works fifty years ago. The air was also preferable to steam for injecting liquid fuels into the furnaces.

Discussion being invited, Mr. Neal said that, after trying both air and steam, he found a better plan than either was the use of common salt. Some two gallons were thrown into the back of the retort; and the carbon was removed in about the same time as formerly. The carbon was not burnt, but came out in blocks, and was used either for the furnaces or the generators. Mr. Coggeshall found that the plain air process, though it took a longer time, did not injure the retorts so much as the steam. Mr. Sherman, replying to questions, said in his case steam occupied 20 to 24 hours; and air, 15 to 18 hours.

After some further business, the meeting closed.

Mr. W. Santo Crimp, M.Inst.C.E., has resigned his appointment of District Engineer to the London County Council, and has entered into partnership with Messrs. John Taylor and Sons, Civil Engineers, of Great George Street, Westminster. Mr. Crimp is an authority on all matters relating to municipal engineering, is the author of several papers on sanitary engineering, and of a standard work on sewage disposal; while his partners were for a long time connected with two of the London Water Companies, and have for a number of years past acted for many of the Provincial Water Companies. They are the authors of an exceedingly useful series of diagrams on the discharges of water-mains, a notice of which appeared in our columns when the work was published about two years ago.

CONVEYORS AND ELEVATORS FOR GAS-WORKS PURPOSES.

It does not need any special familiarity with matters relating to gas manufacture to discover that there is a strong desire among gas engineers to be practically independent of the drawbacks of strikes, both without and within; that is, strikes at the collieries and strikes in the retort-house. In every district, and at every turn, numerous signs are presented of the fact that the automatic handling and storeage of coal in yards, and self-acting re-loading and distributing systems in the retort-house, are being rapidly adopted. In a modern gas-works, carbonizing from 20 to 500 tons of coal daily, the storeage, distribution, stoking, and drawing cannot be economically done by manual labour. The great majority of gas-works have railway sidings, or are located on or near a canal or navigable river; and the tendency of the times is to take the coal from the waggons or barges automatically, by means of elevators, and transmit it to the storeage or retort-house by the aid of conveyors. This change, from doing the work of handling the coal and coke almost entirely by manual labour, to the methods of performing it wholly by mechanical means, has been a very gradual one in all classes of factories; but the rate of progress has been greatly accelerated in gas-works within the last four years, owing to conveyors and elevators having been designed and manufactured in styles which render them the more durable and economical of labour-saving apparatus. The experience which has thus been gained has demonstrated that conveyors and elevators for gas-works must be simple in design, strong in build, easy of application, free from repeated cost in maintenance, and low in working expenses. These essentials are claimed to be the characteristics of the conveyors and elevators shown in the accompanying illustrations, which are the result of the labours of Mr. Gilbert Little (Managing-Director of the New Conveyor Company, Limited, as well as of Messrs. Barry, Henry, and Co., Limited). These forms of conveyors were not produced without the usual expensive experience common to the introduction of all new machinery, due either to defects in details of manufacture, or to other drawbacks known to all who have had much to do with the production and erection of old arrangements under new conditions. It is well known that elevators and conveyors have been used in all kinds of factories for upwards of half a century; and Mr. Little's firm at Aberdeen have made a specialty of these appliances since 1835. Since 1888, however, when he formed the New Conveyor Company, to supply only conveyors, elevators, and accessories, more than 300 installations have been erected, over 30 of which have been more or less extensive installations in gas-works. Reference has already been made in the JOURNAL (see Vol. LIX., p. 1240) to the installation at the Coventry Gas-Works, the new retort-house at which was furnished throughout under the supervision of Mr. G. Winstanley, Assoc.M.Inst.C.E., the Gas Engineer to the Corporation, with the Company's automatic coal-conveying machinery.

The chief difficulties encountered were the wear and tear of the ordinary conveyors used to transmit the coke from the retort-house to the yard. It was seen that the ordinary push-plate or tray conveyors would not answer for the work of distributing coke over a yard, or trim it into a range of hoppers or a train of waggons. The difficulties have been met by the tilting-bucket conveyor, shown in fig. 1 (p. 641). As will be seen the conveyor consists of two endless steel chains, having the buckets hung on spindles. They hang in a vertical position, by gravity, no matter how zig-zag the path or the run of the conveyor. The chain is composed of the New Conveyor Company's heavy long pith steel links; and on the spindles, between the buckets, flanged wheels are fixed. These wheels travel on light rails, or on angle or T-iron paths. The conveyor is run at a low speed; but, with buckets 18 in. by 18 in., more than 40 tons per hour can be carried. The conveyor will work at any incline, and can be fixed to trim coke in stacks from 10 to 50 feet high. The line of the conveyor, when fixed in a yard, is such that the delivery is what is known as the "flowing" throw off; so that breakage of coke is obviated. Extensive arrangements on this system have been set out to the drawings of Mr. Charles Hunt, of Birmingham, and Mr. A. Dougall, of Hull. These are on view at the London offices of the Company.

Fig. 2 is an illustration of the latest form of tray conveyor to carry coal and coke, when delivery has only to be made over the end, and not trimmed all over a yard, as is done by the tilting-bucket conveyor. This form is also used to convey the slaked coke along the front of the retorts to feed the main tilting-bucket conveyor, which runs out into the yard or fills the railway trucks.

In fig. 3 (p. 642) is shown an entirely new departure in coal conveyors; and in cases where wheels of fairly large size can be used, no doubt is entertained by the patentee that it will supersede his different forms of chain conveyors. It will be seen that a steel rope is used instead of a chain. In the experimental stages, this conveyor was almost abandoned, owing to the trouble caused by a few details. The special difficulty was the "clips," or attachments, which serve to secure the push-plates to the rope. These, in passing over the grooved wheel, did not allow the rope to bed itself all round in the packing; and this circumstance caused a slight "kink" in the rope just at the clip, which gradually frayed the

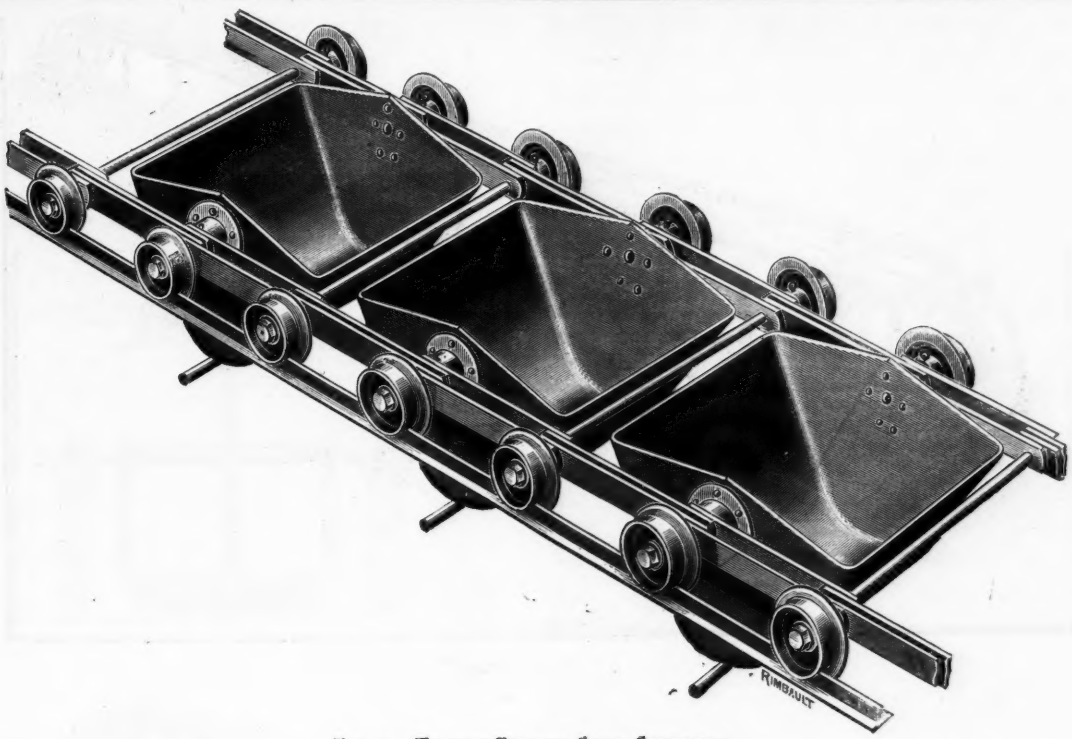


FIG. 1.—TILTING-BUCKET COKE CONVEYOR.

rope. This very small detail promised to destroy the hopes formed of the rope conveyor; but it has been successfully overcome by improvements made after a great deal of expensive experimenting. Mr. Little now uses a "vice" or "jaw" form of clip, packed on the sides with white metal. The top of the clip is open, like the top of a vice, which allows the rope to bear on the packing of the end wheels all round. This entirely obviates "kinking," and consequently removes the cause which formerly frayed and broke the rope. For long coal conveyors, of great strength, and where pulleys from 3 ft. 6 in. to 4 ft. 6 in. can be used, the rope conveyor possesses many advantages. Although the side wheels are dispensed with, and only slide-plates used, the conveyor is noiseless.

Fig. 4 (p. 642) is an illustration of Mr. Little's patent steel-chain conveyor, which is used in preference to the steel-rope design when only small wheels can be got in, for short conveyors, and in places where there is great heat or very gritty material to be carried. The chain is of stamped steel, with short pitch links. The cross-bars are made of malleable cast iron, with lugs cast on, which form the clips to attach the push-plates. This very strong and simple method makes it now unnecessary to have special and expensive links for the attachments; and, besides, it more than doubles the strength of the chain. The longest steel-chain conveyor at work in this country is about 500 feet; and the strain, when loaded and conveying coal at the rate of 30 tons per hour, is not more than a ton. The breaking strain of the smallest size of Mr. Little's steel chain is 9 tons; and of the largest, 22 tons. This gives an enormous margin of safety. Another important feature is the fact that the deep link chain, as shown in fig. 4, possesses a life from two to three times longer than the flat and round chains hitherto used; and a conveyor with the latest design of chain and attachments will not need a link renewed for several years. The same design of chain and attachments is now employed on Little's patent coal, coke, and lime elevators. The malleable cast and ordinary iron chains which the New Conveyor Company found amply strong and durable for collieries and factories generally, did not possess sufficient wearing surfaces for gas-works needs. Hence the great additions to strength, the marked departures in construction, as well as the all-round alterations brought out in the illustrations here given.

It may be added that the Company have laid out works with special plant to manufacture the durable and unbreakable conveyors and elevators required to meet the conditions obtaining

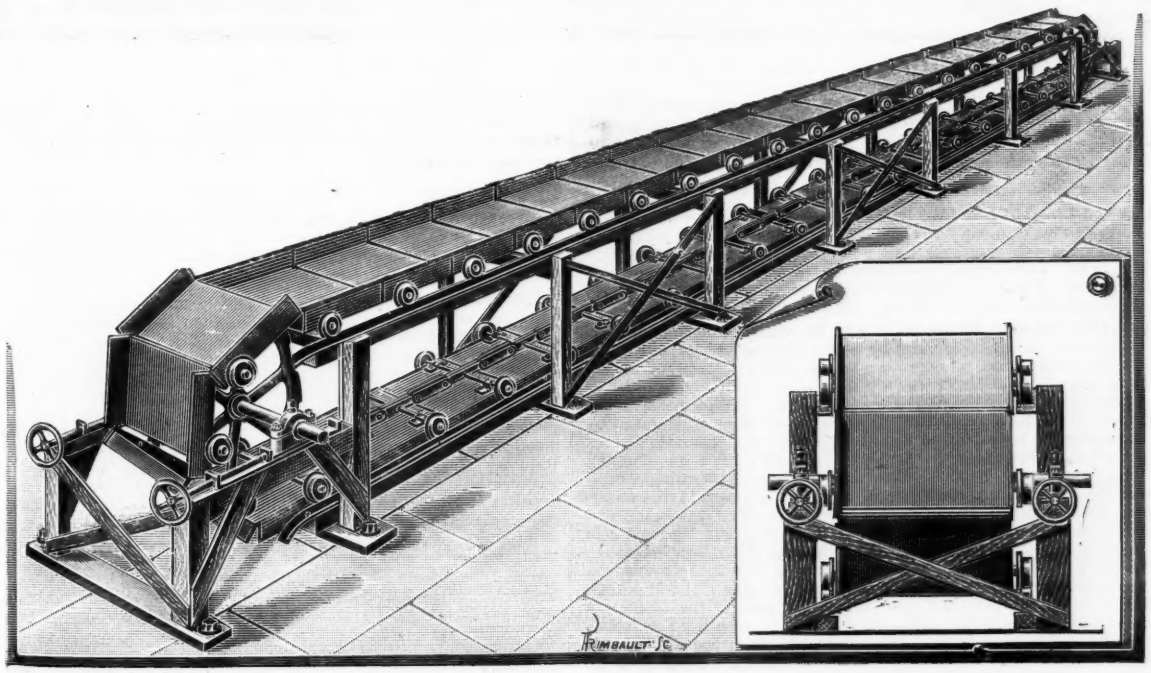


FIG. 2.—LITTLE'S PATENT STEEL-CHAIN TRAY CONVEYOR.

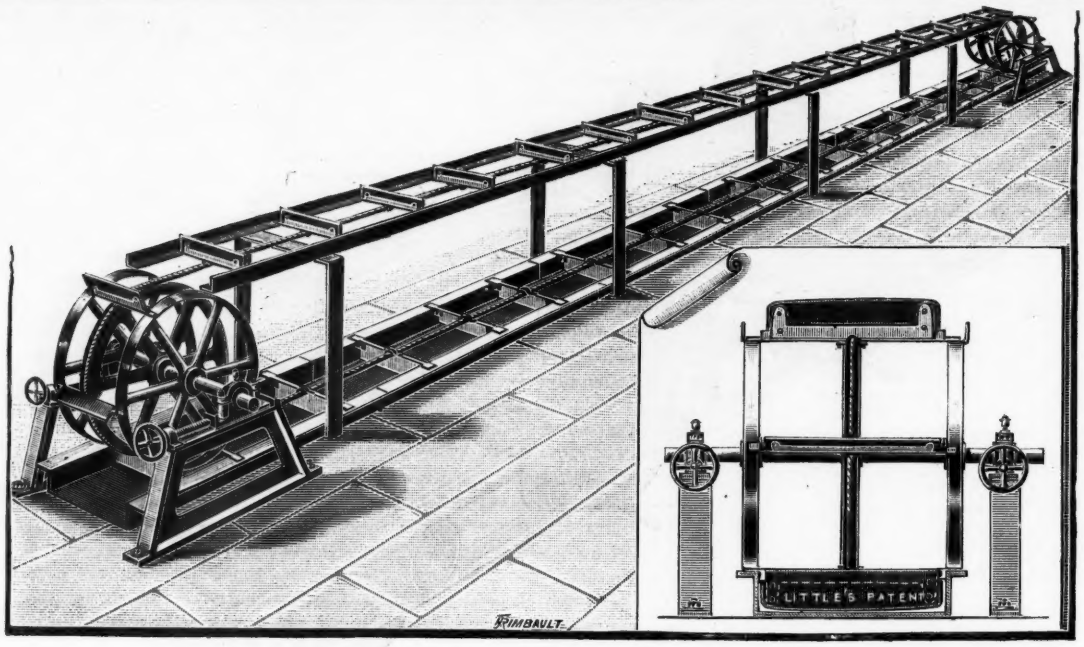


FIG. 3.—LITTLE'S PATENT STEEL-ROPE CONVEYOR.

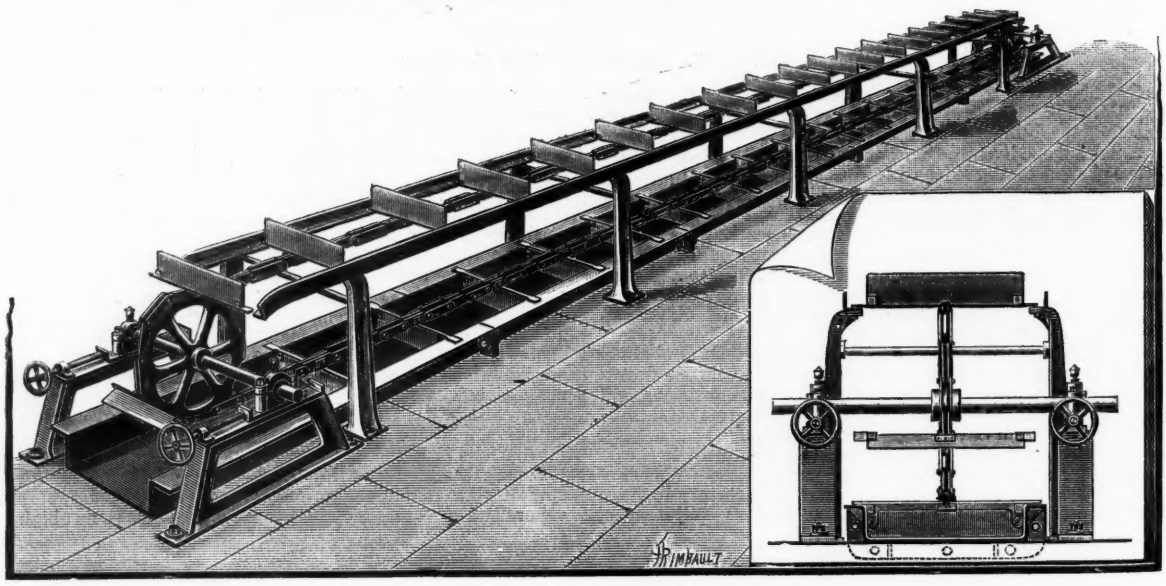


FIG. 4.—LITTLE'S PATENT STEEL-CHAIN CONVEYOR.

in gas-works; and, with the facilities they now possess, they are able, we understand, to deliver the complete conveying and elevating plant, including the engines, coal-breakers, and general ironwork accessories, for an ordinary size retort-house in a period extending from four to six weeks. The tools used for stamping the buckets, trays, and trough are claimed to be among the most powerful stamping machinery at work in any part of Europe.

Gas and Electric Lighting in Canada.—A controlling interest in the Ottawa Gas Company and the Ottawa Electric Light Company has been bought for $500,000 by a Syndicate having its headquarters in Montreal. The persons who compose the Syndicate now have a Bill before the Dominion Parliament to secure power to buy up and amalgamate all the gas and electric light companies in Canada.

Local Government Board Inquiry at Worcester.—Last Thursday, an Inquiry was held at Worcester by Major-General Crozier, one of the Inspectors of the Local Government Board, with reference to applications by the Corporation for permission to borrow money, in order to carry out electric lighting works and increase the filter-beds at the water-works. The Town Clerk gave a *résumé* of the action taken by the Corporation in respect to electric lighting; and it was explained that the total expenditure contemplated under this head was £39,109, for the purchase of Powick Mills, for buildings, generating works, cables for transmitting the current, &c. With regard to the water-works, the proposed expenditure was £4500. The Inspector was informed that a strong opinion had been expressed in Worcester in favour of using polarite for further purifying the water supplied to the city, and that the Council had been offered the free use of a quantity as an experiment for a period of eighteen months. The Inspector intimated that it would be a wise step on the part of the Council to test the merits of polarite; saying that, although he had no acquaintance with the use of it for purifying water, his experience of it, in connection with sewage-works led him to believe that the contention of the Company was fully borne out by the results.

Increase of Wages at the West Bromwich Gas-Works.—The Gas Committee of the West Bromwich Corporation have increased the wages of the coal and coke wheelers, stokers, and carbonizing foremen in the service of the Corporation.

Southend Gas Company.—The annual general meeting of this Company was held on the 30th of March, when the Directors presented their report, which was accompanied by the accounts for the year ending Dec. 31 last. The gas-rental amounted to £7499—an increase at the rate of 15 per cent. as compared with 1891; but the prices realized for residuals were less, although the sales were larger. The balance of net revenue account available for division was £1034. As £680 had been already paid as interim dividend, the Directors recommended a further payment of £970, which would complete the statutory dividends. The new gasholder, the tank for which was commenced towards the close of June last, is nearly finished, and is expected to be in operation by Midsummer. The Directors have in contemplation an extension of the purifying apparatus; and this, with other alterations which have been carried out, will, they say, enable the Company to meet all requirements for some time to come. The working statements show that 3413 tons of coal and cannel were carbonized; the residual products being 3078 chaldrons (48 bushels) of coke, 356 chaldrons of breeze, 24,380 gallons of tar, and 90,740 gallons of ammoniacal liquor. Of the quantity of gas made and in store, 30,485,300 cubic feet were sold to private consumers, and 2,831,600 cubic feet for public lighting and under contracts; making a total of 33,316,900 cubic feet.

REGISTER OF PATENTS.

Gas and Petroleum Motors.—Sabatier, L., Roche, J., and Rodier, L., of Bagnot, France. No. 608; Jan. 11, 1893.

This invention relates to motors actuated by gas, gasoline, or petroleum, of horizontal or vertical type; and it has for its object: "First, to prevent the injurious effects which result in economy; second, to simplify the organs of distribution, ignition, and exhaust of the burnt gases; and, third, substituting the valves and firing-slide actuated alternatively by one disc only rotated intermittently by a connecting-rod."

Charging Gas-Retorts.—Webster, J., of Cagliari, Italy. No. 874; Jan. 14, 1893.

According to this invention (which is for the most part applicable to gas-works of small and medium size, instead of filling the retort-charging scoops with coals from a heap in the retort-house, the patentee proposes to charge them in the coal-store; and for this purpose to lay a tramway from the coal-store to the retort-house and the whole length of the latter. On this tramway a truck is run, the body or frame of which is adapted to carry a number of scoops the same as the number of retorts in a bench, and which turns around a central vertical pivot, or like a turntable. Overhead (parallel with the tramway) is a wire rope, upon which is run a small carriage, with a hoisting and lowering winch, constructed with drum (by preference) worked by worm and worm-wheel gear from a pendent endless chain, which latter is within reach of any person on the floor of the retort-house. From a winding chain on the drum is suspended a cradle adapted to take a scoop; a handle fitted to the end of the scoop, and readily unshipped, serving to push the loaded scoop into the retort, and to remove it therefrom. The worm spindle is provided with a fly-wheel, which enables the winch-chain to be run down quickly. The truck, having been pushed into the coal-store with the empty scoops laid in racks on the truck, is there loaded, and then run into the retort-house and in front of the retort-bench, where, by means of the winch, the contents of one scoop after the other is discharged into the retorts.

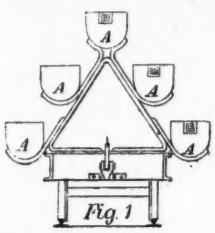


Fig. 1

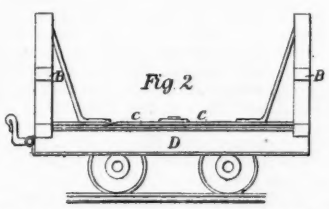


Fig. 2

Fig. 1 is an end view, and fig. 2 a side view of a truck adapted to carry five scoops triangularly—one upper central one, and two on each side—in the same relative positions as the retorts in the bench for which it is intended. The scoops A rest in curved brackets B. The body C of the truck is pivoted on a central pin mounted on the under-carriage D, so that the body can be turned round in any direction suitable for loading or discharging the scoops. Fig. 2A shows a handle E, the end of which can be inserted into a socket on the scoop, and fixed by a key, so as to serve for pushing the scoop in and pulling it out of the retort.

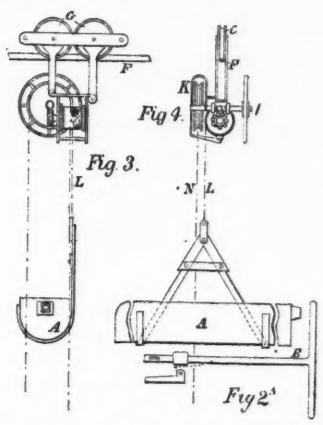


Fig. 4.

Fig. 3.

Fig. 2A

The winch is shown in front view in fig. 3, and end view in fig. 4. On the overhead wire rope F in the retort-house, the wheels G run. In the lower part of the carriage-frame is mounted the winch-drum H, having a worm-wheel, which, by the worm on the spindle I, can be rotated from the sheave K, with the pendent endless chain. From the winch-drum H is suspended by the chain L a cradle, formed with two curved arms adapted for the scoop A to rest on. The fly-wheel shown aids the stoker in bringing the chain quickly down.

Fig. 5 is a front view of a retort mouthpiece M, and fig. 6 a side view of same. Figs. 7 and 8 are two similar views of the retort, but with a working part or carriage N in another position. The under side of the retort mouthpiece M is formed with two slotted lugs, to which is hinged the carriage N for the roller. The latter, when in the raised position indicated, supports the scoop A; and when lowered and slid back under the mouthpiece it is quite out of the way.

The truck B C D, having had its scoops A filled in the coal-store, is run into the retort-house, and brought opposite one bench of retorts after the other. When opposite a bench, the body B C of the truck is turned round the pivot D, so that the front ends of the scoops face the retorts. The winch having been run along its wire rope F into a

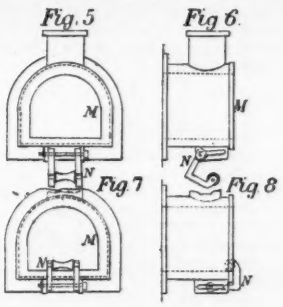
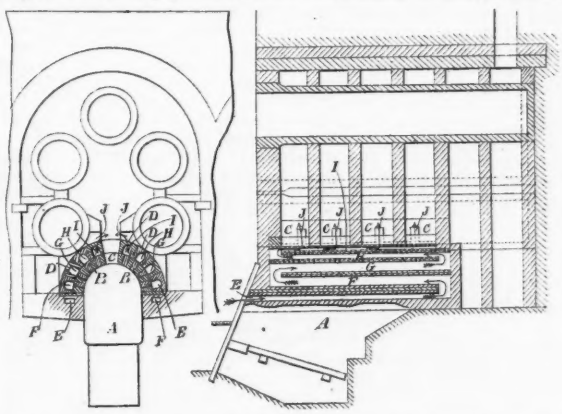


Fig. 5 Fig. 6 Fig. 7 Fig. 8

position close to the scoop-carriage, the scoops are one by one suspended in the cradle shown in figs. 3 and 4, and, by means of the handle E (fig. 2A), pushed into the retorts—the scoop support N having been raised into the scoop-supporting position (figs. 7 and 8). The scoop framing or body B C having received the empty scoops, the framing is turned round and fixed in position by a catch or bolt; and the carriage B C D can then be run back into the coal-store to have the scoops reloaded. After the charging, the scoop supports are one by one lowered by the scoop coming against the roller in the act of withdrawing the scoop from the retort; and they are then run back into the normal position shown in figs. 5 and 6, the incline of the slots in the lugs assisting this action. When in this position, it is clear of any coal or tar that may drop from the retort mouthpiece.

Setting Gas-Retorts.—Gibbons, W. P., of Dudley, and Masters, R., of Bedford. No. 1269; Jan. 20, 1893.

As is well known, in "producer" or "generator" settings, provision must be made for the admission of the secondary air supply to complete the combustion of the carbonic oxide produced in the generator; and it is of great importance that the air shall attain such a degree of heat before meeting with the gases formed in the producer that proper combustion may take place. These requirements the patentees propose to obtain by providing small longitudinal air-flues in the arch



of the producer arranged to admit and heat the air, and cause it to properly combine with the gases as they issue through the producer nostrils. The arch of the gas-producer A is constructed first of an inner ring B of fire-bricks throughout, except where nostrils or outlets C are required. Over the arch B an arch is formed by preference of specially moulded fire-clay blocks D, shaped so as to form longitudinal secondary air-flues in each side of the arch. These secondary air-flues are arranged zig-zag, so that the air first enters the two bottom flues E at their front ends, which are open to the front of the setting. The air then passes to the back of the producer, and then returns to the front along the next flues F, flowing back again along the next higher flues G, and returning along the next higher flues H. It then flows again towards the back along the highest flues I; and from these the air, heated as required, rises up through the hot-air outlets J opening immediately above the nostrils C. These hot-air outlets J are arranged so that the heated air will leave the flues I at such an angle as will be best for combining with the carbonic oxide gases leaving the producer through the nostrils C.

The inventors find that four secondary air-flues in each side of the producer arch answer well in practice.

Electric Gas Lighting Appliance.—Sloss, A. M., of Chicago, U.S.A. No. 1356; Jan. 21, 1893.

This invention relates to the combination with a gas fixture or lamp of a battery, a spark-coil, and a case containing the battery and spark-coil, which encloses the junction of the main supply-pipe with the branches supplying the several gas-burners. The case is formed in two parts, separable from each other; and insulated contact springs, forming the terminals of wires leading to the burners or groups of burners, are automatically brought into connection with the terminals of the battery and spark-coil by the closing of the case, so as to emit a spark in close proximity to the gas-jet.

Burners for Gas-Fires.—Fletcher, T., and Clare, A., of Warrington. No. 1658; Jan. 25, 1893.

The object of this invention for use with lump-asbestos gas-fires is to prevent the gas lighting back to the jet. In the burners there are "two co-axial jets pointing in opposite directions in a duplex co-axial injection tube parallel or approximately parallel with the combustion

tube;" the duplex injection tube being joined at each end to the combustion tube by a simple bend. The improvement consists in the introduction of an additional curve or bend at the point where the injection tubes join the combustion tube.

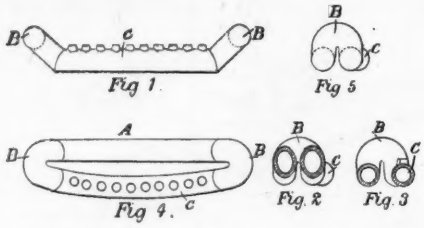


Fig. 1 is a front elevation; figs. 2 and 3, cross sections; fig. 4, a plan; and fig. 5, an end view of a burner, in which the additional bend or curve is in an upward direction.

A is the injection tube; B, the additional curves or bends; and C, the combustion or burner tube, which may be parallel with the injection tube, or curved as represented. The degree of inclination of the additional bends B with reference to the general plane of the burner may be from 30° to 60°; and the amount of deviation in the path of the mixed air and gas produced by the bends, should be from one to one-and-a-half diameters of the tube—the latter amount of deviation appearing to produce the better result. The effect of the additional bends, in the case of a check to the current from draughts or from other causes, is said to be to prevent the flame lighting back to the jets; and this appears to be produced by the accumulation in the bends of an irregular mixture of air and gas, through which an explosion does not readily pass.

Manufacture of Carburetted Hydrogen.—Lewes, V. B., of Greenwich. No. 21,598; Dec. 10, 1891.

This invention relates to the manufacture of hydrogen and its carburation for use as an illuminant. For this purpose steam at a high temperature from a superheater is passed through chambers containing iron, through which products of combustion from a furnace have been passed to heat the iron, and the temperature of which is maintained by the incandescent fuel in the furnace. Simultaneously with the passage of steam through the heated iron, a portion of the steam from the superheater, or from any other convenient source, is caused to flow through injectors in connection with the furnace, and to spray liquid hydrocarbon (such as crude petroleum) into the fuel contained therein; while steam may also be admitted directly to the furnace below the injectors. The gaseous products generated in the furnace mingle with the hydrogen resulting from the action of the steam on the iron, and pass therewith through a fixing-chamber maintained at a constant temperature.

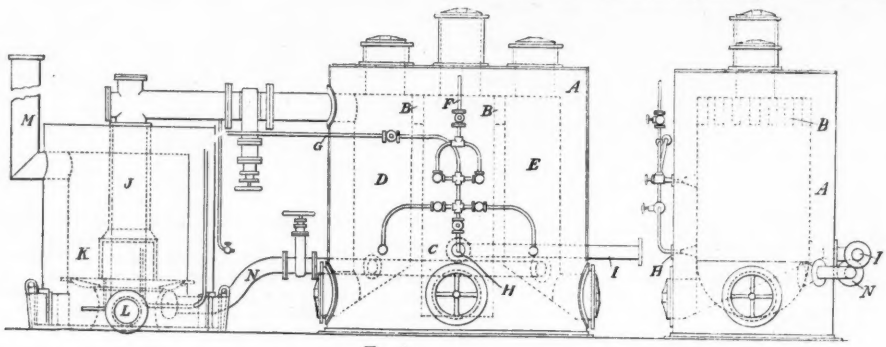
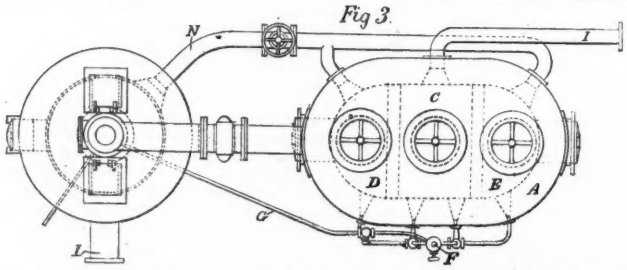


Fig 3.



The outer casing A is lined with fire-brick, and provided with vertical partitions of refractory material that may extend to within a short distance of the top of the casing, or which may (as shown) be provided with a number of openings B for the exit of the gas. The space or chamber C between these partitions is charged with fuel, and serves as a gas generator or furnace; and the spaces D E at each side serve as hydrogen generating chambers to contain iron, or suitable compounds of iron, as described in patents No. 20,752 of 1890, and No. 4134 of 1891. These compounds the carbon monoxide in the products of combustion from the gas-generator will readily reduce to the metallic state. F is an oil-supply pipe, provided with a cock and with branches connected with two injectors, arranged to discharge liquid hydrocarbon into the incandescent fuel in the chamber C at points about midway in its height. G is a superheated steam-supply pipe, connected with the injectors by a branch with a nozzle at H, located near the bottom of the chamber C, and by lateral branches with nozzles near the bottoms of the chambers D E. I is a pipe through which air can be blown into the bottom of the chamber C, for the purpose of raising the fuel therein to incandescence. J is an iron retort connected by a gas-main with the chambers C D E, and through which the gases generated in these chambers are passed, for the purpose of fixing them and producing permanent gas. K is a steam superheating coil-like chamber or coil, cast in the wall of the retort, or embedded in a thick mass of iron or other suitable material, to prevent its being burnt. This superheater is connected with a steam-generator (not shown), and with the steam-supply pipe G. L is the outlet of the retort. The retort and superheater are located in a suitable furnace or combustion chamber charged with fuel—the superheater furnace—and provided with an exit-flue M. N is a pipe for placing the lower ends of the chambers D E in communication with the ash-pit below the fire-grate bars in the superheater furnace.

The mode of working and the action of the apparatus are as follows: Carbonaceous fuel (for example, coke) is raised to incandescence in the furnace chamber C by a blast of air, supplied through the pipe I from a suitable blower. The products of combustion—largely consisting of carbon monoxide and nitrogen—pass through the openings B, and are led down through the chambers D E, containing iron or compounds thereof, and are then conducted, by the pipe N, to the superheater furnace, the combustion in which is supplemented by the combustion of any unused carbon monoxide in the products. By this means, the fuel in the chamber C, the iron in the chambers D E, the fixing-retort J, and the steam superheater K, are heated to the required temperature. The air-blast having been cut off, and the proper connections opened, steam under pressure is allowed to flow through the superheater and into the pipe G, whence part passes into the chambers D E, containing the heated iron, and is thereby decomposed, liberating hydrogen. Another part of the steam passes through the injectors into the incandescent fuel in the furnace chamber C, spraying in at the same time liquid hydrocarbons which have been fed through the hydrocarbon-supply pipe F.

The patentee says that he has obtained satisfactory results by injecting hydrocarbons—such as crude petroleum—with steam at a pressure of about 120 lbs. to the square inch, and heating it to a temperature of about 400° C. By injecting the liquid hydrocarbons into the fuel, they are "cracked" to gas—any carbon, pitch, or the like that may be produced, merely adding to the fuel, while "overcracking" is prevented by the simultaneous generation of water gas from the steam used in injecting. Steam may from time to time be also injected through the nozzle H into the incandescent fuel, at a point below that at which the hydrocarbon is being cracked; and in case of overheating, or at the end of each run, the hydrocarbon in the gas generator or chamber C will be cleared out by an uprush of water gas produced by the decomposition of the steam thus injected. The carburetted gas produced as described in the chamber C meets (at the top thereof) the currents of hydrogen generated in the chambers D E, and flows therewith to the fixing-retort J; and this, being kept at an approximately constant high temperature of (say) about 1000° C., uniformly fixes these gases, so as to produce a permanent gas. The resulting gas, owing to the dilution by hydrogen and the interactions between carbon monoxide and the nascent hydrocarbons in the chamber C, contains but a small, and practically harmless, percentage of carbon monoxide, as before stated. Where the presence of carbon monoxide is not objectionable, more steam may be admitted to the furnace at a point below that at which the oil or hydrocarbon is being injected; and the production of pure hydrogen in the chambers D E may be reduced or dispensed with—producing the result described in patent No. 16,258 of 1892.

The production of carburetted hydrogen continues until the temperature of the fuel in the chamber C has fallen below the required point. The steam and oil are then shut off; and the various connections are adjusted as before for the passage of an air-blast. Any traces of hydrocarbon remaining in C assist the carbon monoxide to reduce to the metallic state the iron that has been oxidized in the chambers D E by the steam ready to repeat the foregoing operations.

The relative quantities of the steam and oil admitted into the incandescent fuel are so regulated that the gas generated in C shall be of a brown colour. If the gas be white, it indicates that the oil is not sufficiently cracked, and the proportion of steam should be reduced; if the

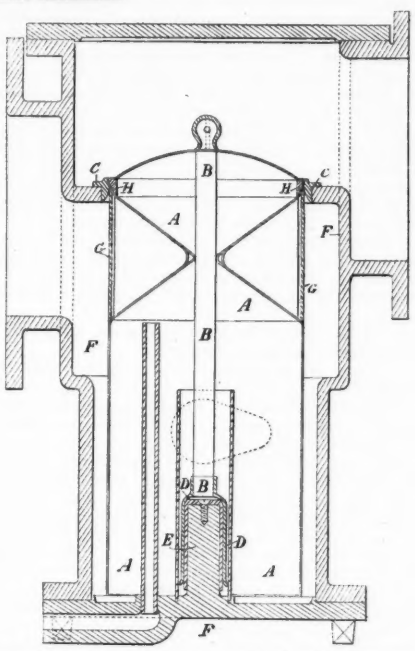
gas be black and "sooty," it indicates that the oil is being overcracked, and the proportion of steam should be increased.

At the close of his specification, the patentee says that, having discovered since the date of his application for this patent, that a part of the process and apparatus used in carrying it out "can be advantageously used separately and apart from the other features" of the present invention, he has applied for a patent (No. 16,258); and, in the specification thereof, has described "a new and useful method of employing the following features considered separately and apart from the use thereof in conjunction with the production of hydrogen according to the process herein described—viz., (*a*) The manufacture or production of illuminating gas from liquid hydrocarbons by injecting such hydrocarbons, by means of steam, into a mass of red-hot or incandescent fuel; (*b*) in the process just indicated under A, injecting steam from time to time as may be required, into the incandescent fuel at a point below that at which the liquid hydrocarbon is being cracked, so that, when desired, the hydrocarbon gases in the gas-generator can be removed by an uprush of water gas produced by the decomposition of the steam thus injected; and (*c*) the herein described oil-cracking apparatus constructed separately and apart from the herein described apparatus."

The principal claim for the present invention is for a method of "manufacturing or producing carburetted hydrogen by cracking liquid hydrocarbons in the presence of water gas and red-hot or incandescent fuel, and diluting the resulting gas to reduce the proportion of carbon monoxide therein to the desired extent, by mixing it with hydrogen simultaneously produced in a separate generator by the action of steam on heated iron."

Regulating the Flow and Pressure of Gas.—Foulis, W., of Glasgow. No. 7923; April 27, 1892.

This invention—relating to "improvements in apparatus for regulating the flow and pressure of gas"—is a modification of that described in patent No. 3655 of 1876—the present invention having for its object "to provide more efficient means for guiding the regulating cone or bell inside the governor or case, whereby the friction is reduced to a minimum and all tendency to jump or oscillate, when the valve is nearly closed, is overcome; also, by means of an improved shape of the valve-seat, the ring and cone meet with an equal curve and so ensure steadiness."



The cone or bell A is built upon a central spindle B, mounted true with the valve-seat C. The spindle is provided or formed at its lower end with a barrel or cylinder D, which fits easily on a piston or plunger E, fixed in, or formed on the bottom of the case F, and preferably provided with a non-corrosive metal covering. As the cone or bell A rises or falls, some of the liquid (preferably glycerine) contained within the case passes into or out of the cylinder, which is on the lower end of the spindle; and this can only take place by the liquid passing the piston, or by passing through an orifice made in the cylinder for the purpose. The bell is guided at its top end by narrow vertical bars or guide-rods G, mounted across the conical opening of the bell. The valve H on the top end of the bell, and also the ring or valve-seat proper, are made of an equal curved shape, so as to ensure the cone or valve H and the seat meeting with an equal curve, and thus regulate the governor.

The whole apparatus, says the patentee, thus forms "a steady, sensitive, smooth, and efficient working gas-governor, which has no tendency to jump or oscillate owing to the variations of the inlet pressure; and so any sudden change of pressure taking place is prevented, as the rise and fall of the bell is slow and steady, owing to the space inside the barrel D requiring to be filled or emptied by the liquid according to the movement of the bell."

New Water Filter-Beds at Rochdale.—The Rochdale Town Council on Thursday last adopted a proposal of the Water Committee to construct new filter-beds at the Spring Mill reservoir, at an estimated cost of £3800.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

The Entry of Parliamentary Expenses in Gas Companies' Accounts.

SIR,—I have heard repeatedly that item No. 19 in the Revenue Account (D) in Schedule B to the Gas-Works Clauses Act, 1871, perplexes the minds of some individuals in the gas world; but I cannot comprehend the reason why, because legal expenses are not a source of revenue in the working of a gas company, but a direct loss or expense. Therefore legal expenses should be provided for out of profits arising from the business of the company. If legal expenses and other "no value" assets were disclosed on a balance-sheet, then shareholders might like to see a depreciation fund also figuring thereon; and when the amount had totalled such "no value" assets, this depreciation fund could be increased to meet the deterioration in the value of plant, &c. I may say that a renewal fund is not meant to cover depreciation, and that one advantage of a depreciation fund would be that it could not be reduced to increase the amount for payment of dividends.

If any of your readers disagree with "Querist," whose letter appeared in the JOURNAL for the 28th ult., I should be pleased to read their views.

London, April 8, 1893. FACTOTUM.

Experimenting with a View to the Development of Gasholder Construction.

SIR,—It may possibly be remembered that the recent discussion between Mr. Cripps and myself originated in the suggestion I made that the sheeting of a gasholder is stronger than it is generally considered to be. I also suggested that this was sufficiently the case to give a holder stability without the assistance of vertical stays. This latter point has brought up the question of the amount of strain that the sheets would have to stand under such a case.

With regard to the first point, I think I may fairly assume that some sort of a case was made out, seeing that Mr. Cripps has not seriously contested the argument that the inner lifts of a gasholder at least are sufficiently strong in the sheeting alone to withstand the strain of the wind, when inflated. This appears to me to justify the assertion that the sheeting of the inner lifts of a gasholder may be considered to have very considerable strength. I also argued that, if the sheeting of the outer lift of a gasholder is sufficiently strong to stand during erection without support, it is capable, in most cases, of withstanding the strain of any compression that is brought upon it while inflated.

This last point brought up the question of the 300-feet gasholder; and it is to this that Mr. Cripps, in his last communication, has paid most attention, and has taken most exception. The chief point that suggests itself in connection with the view held by Mr. Cripps is whether the fact has not been overlooked that a telescopic gasholder is a linked vessel, the different links of which are only united when the vessel is suspended. These conditions appear to be absolutely opposed to those necessary for the transmission of compression from the higher portion of a lofty structure to the lower. Where there is no rigid connection between the different parts, it is difficult to see how a moment of compression can exist. If the holder alluded to were all in one piece, it would no doubt be necessary to estimate the overturning moment in accordance with Mr. Cripps's figures.

In my view, however, if the outer lift of a gasholder is suspended, it cannot be held to be in compression, except from the horizontal force it is required to resist at its point of connection with the rest of the holder, together with the force of the wind it has to resist against its own sides. What Mr. Cripps represents as the overturning moment seems to me to be met by the counterbalancing action of the outer lift of any series of lifts. While this is free to rise or fall in a level position, the equilibrium of the upper part of the holder is maintained by the transference of a portion of the weight of the outer lift from the side that is tending to sink to the side that is tending to rise. The decrease in weight on the one side is equal in importance as a factor to the increase of weight on the other. (To the amount of the weight transferred, a portion of the outer sides must be carrying weight. This was omitted in estimating the compression in my last letter.) If the outer lift is suspended and remains parallel, it is obvious that the entire holder must remain parallel, unless the whole weight of the outer lift suspended on the windward side of the holder is sufficient to act as a counterbalance. If this is so, the state of equilibrium of a holder is a problem quite apart from the compression set up in the sides of the outer lift.

Given a holder that is thus in a level position, what strain have the sides to withstand? Is it not the sum of the wind pressure on the five upper lifts applied in a horizontal direction to the outer gasholder through its dip? If so, I believe the figures in my last letter are correct. Mr. Cripps takes exception to the weight of the outer lift in that letter. I find that I included in it what I intended to include—viz., the sides above the bottom curb, with the dip attached, and without vertical stays. The weight is approximately that given. I also suggest that the buckles to which Mr. Cripps refers may be large buckles due to bad riveting, or other causes, and not sharply-defined buckles which might be expected close to the bottom curb if the sides were about to collapse. It should also be noticed that, for a considerable distance above the bottom curb, the sides are not flat, since they retain the curvature supplied by the strong ring, and that even the slightest amount of curvature produces a great amount of additional strength. This is also the case with the dip. In a long, narrow girder, such as the outer lift of the South Metropolitan gasholder, the existence of these two strong flanges certainly should be allowed for; so also should the horizontal tensional strain set up by the inflation of the holder at 12 inches of pressure, as a factor in strengthening the sides. It was not, however, within the scope of my original communication to discuss the engineering points of any structure, but merely to make a suggestion of much wider bearing.

I have endeavoured to represent above that there are, in reality, two distinct problems in connection with telescopic gasholders. The one

applies to the balancing of the holder against the wind by means of the weight of the bottom member, which is always horizontal and supported; the other deals with the strains set up in the holder when in its balanced condition. It was in relation to this that the figures in my last letter were given. Whether or not they are correct is influenced by the question to what extent a body unsupported at the bottom and hanging by the top, as an outer lift, can be subject to vertical compression theoretically. And, in relation to the large holder mentioned, my view is that there cannot be any overturning moment, as shown by Mr. Cripps, but that, if 113 tons of the weight of the bottom lift were supported by the windward instead of the other side, the structure would be upright in a 45 lbs. gale.

If there arise any advantage from this discussion, it is that which is aptly described by Carlyle when he says: "The *dust* of controversy, what is it but the *falsehood* flying off from all manner of conflicting true forces—that so the truths alone may remain and embrace brother-like in some true resulting force."

E. Lloyd Pease, Managing-Director,
Ashmore, Benson, Pease, and Co., Limited.

Stockton-on-Tees, April 8, 1893.

Darlington Corporation Water Department.—The result of the working of the Darlington Corporation Water-Works during 1892 is a net profit of £2310, of which £2000 is to be handed over to the rates.

The Electric Lighting Question at Guildford.—About two years ago, some local gentlemen applied to the Guildford Town Council for their consent to the grant by the Board of Trade of a Provisional Order for empowering them to supply electricity in the district. The application was referred to a Committee, who, having taken the modest time above mentioned in which to consider the matter, have come to the conclusion that consent may be given, provided conditions satisfactory to the Council can be arranged, and that provision is inserted in the Order for the sale to the Council of the undertaking upon equitabel terms and within a reasonable period. This resolution was confirmed by the Council at their last meeting.

Tenders for Corporation Work at Warrington.—At the last meeting of the Warrington Town Council, Mr. R. T. Fairclough, the Chairman of the Gas Committee, moved: "That the following resolution, passed by the Council at a meeting held on April 5, 1887, be rescinded—viz., 'That all Committees of this Council shall be required for the future to procure the whole of their requirements, whether for materials to be supplied, or labour to be performed, or both, by tender, and that whenever the same shall involve an expenditure of £20 and upwards, tenders be publicly advertised for, and that every accepted tender shall be published with the minutes of the Committee connected therewith, together with the price and the name of the successful firm.'" Mr. Fairclough said that, if the resolution was not rescinded, they might find the town in darkness some day when they least expected it. He contended that the Gas Committee should be placed in the same position as the directors of public companies, except in regard to salaries. If large firms were required to advertise for tenders for anything of the value of £20, their chances of profits would be infinitesimal. He could not see the wisdom of keeping a resolution on the standing orders when it could not be adhered to without serious loss. Mr. Roberts pointed out that the resolution in question had been on the books several years, and yet the town had not been plunged in darkness in consequence. It was passed originally because of the Salford gas scandals. He maintained that Mr. Fairclough had not made out a case, and asked the Council not to rescind the resolution until they had something better to take its place. Several other members followed in a similar strain; and some of them stated that considerable sums had been saved through tenders being obtained. Mr. Fairclough remarked that the Gas Committee always procured tenders when they could; but there were occasions when they should have more freedom. Being pressed to withdraw his motion, Mr. Fairclough eventually consented to do so, but stated that he would bring the substance of it forward again.

Exhibitions of Gas Appliances.—The gas exhibition held in the Albert Hall, Dewsbury, to which reference has already been made, was brought to a successful close on Wednesday, the 29th ult. The display made by Messrs. Fletcher, Russell, and Co., Limited, was specially noteworthy; comprising not only a large variety of cooking-stoves, but an extensive collection of their latest achievements in gas appliances. Their new patent enamelled steel linings, to take out of ranges, were much appreciated. The cookery lectures by Miss Annie Smith proved an attractive feature of the exhibition. At the closing ceremony, thanks were accorded to Mr. C. A. Craven, the Gas Engineer of the Corporation, who first suggested the exhibition; and also to those who had contributed to its success. An exhibition of gas appliances manufactured by Messrs. R. and A. Main, of Glasgow, was opened in the Picture Gallery, Arbroath, last Tuesday, and was continued till Friday. On the evening of the opening day, Mr. A. P. Main delivered a lecture on "Cookery, Ancient and Modern," to a large audience; and during the week Miss Hunter gave a series of lessons and demonstrations. The same firm have just concluded a fortnight's exhibition in the Albert Hall, Edinburgh, where Mrs. Hall gave the lectures. A very successful exhibition, promoted by the Grimsby Gas Company, has lately been held in the Temperance Hall in that town. Messrs. Richmond and Co., Limited, had an excellent display of gas stoves and ranges; a large number of which were let on hire. Cookery lectures were delivered by Miss Owen to appreciative audiences. The Secretary of the Christchurch (N. Z.) Gas Company—Mr. R. C. Bishop—does not relax his activity in advocating the use of gas for cooking purposes. A successful exhibition of gas appliances—many of them manufactured at the Company's own works, under the supervision of Mr. M'Kenzie, their Manager—was lately held in the Tuam Street Hall, Christchurch, at which cookery lectures were delivered by Miss Ada Wardrop. Some of these have been reprinted as leaflets, with the Company's terms for the sale or hire of their stoves on the reverse side. Mr. Bishop introduced Miss Wardrop with a few appropriate remarks on the advantages of gaseous fuel for culinary operations.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following progress has been made with Bills since the re-assembling of Parliament after the Easter recess:—

Bills read a second time and committed: Bodmin Water Bill; New Swindon Gas Bill.

Petitions against the following Bills have been presented:—

Accrington Gas and Water Bill, from the Corporation of Accrington and the Local Boards of Church, Clayton-le-Moors, Great Harwood, and Rishton.

New Swindon Gas Bill, from the Swindon New Town Local Board.

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* H. J. Roby, *Chairman; Sir* G. Chesney, *Sir* J. Kitson, *and Mr.* Mildmay.)

Wednesday, March 22.

BRIGHTON AND HOVE GAS BILL.

This Bill—which was promoted by the Brighton and Hove General Gas Company to enable them to raise further capital, acquire additional lands, and extend their limits of supply—came to-day before the above-named Select Committee; the measure being opposed by the Brighton Corporation.

Mr. Littler, Q.C., Mr. Herbert Saunders, Q.C., and Mr. Freeman appeared for the promoters; Mr. Cripps, Q.C., and Mr. Claude Baggallay, Q.C., represented the opponents.

Mr. Littler, in opening the case, said the Bill had been promoted by the Brighton and Hove Gas Company, for the purpose of obtaining an increase of capital, and of securing additional land on which to construct works. Another of its objects was to extend the limits of the Company's supply, so as to include certain parishes which were becoming more or less populous. The Company was originally constituted in 1825; and from time to time there had been amalgamations with other Companies. From the accounts for the half year ending December, 1892, it would be seen that the Company had first of all £120,000 of original 10 per cent. capital under Acts passed up to 1848. Then they had, under their Act of 1839, £100,000, which was also entitled to 10 per cent. The Company were now, although they were not at the time this capital was issued, under the sliding scale. The total capital authorized was £495,000, the whole of which had been paid up. The total borrowing power was £95,000, the whole of which had been exhausted. It was therefore absolutely necessary for the Company to come to Parliament for more money. They sought to increase their capital by £300,000 in shares and stocks, with borrowing powers to the amount of £75,000, which, it was calculated, would carry them on for twelve or fourteen years—this being the time usually recognized by Parliament as a proper term.

The Chairman asked where the works were situated.

Mr. Littler replied that they were about 1½ miles from the west end of Brighton. As the borough was extending at a very rapid rate, it was necessary that the Company should have power to enlarge their limits of supply.

Mr. Baggallay remarked that the Corporation did not object to the Company taking in the southern portion.

Mr. Littler said he understood this to be so; but there were certain other districts which would not be able to afford to erect their own gas-works, and therefore the Company proposed to extend their limits of supply. Another clause in the Bill was to authorize them to manufacture and deal in gas fittings and stoves. As far as the latter appliances were concerned, a great many gas companies now had the power to deal in them, and also in fittings. Consumers abused their fittings simply because neither they nor their gas-fitter quite understood what were the most suitable; and the Company were constantly being applied to by people who desired to be supplied with the best fittings, and they had no power to satisfy them. With regard to stoves, it was becoming more and more important that gas companies should be enabled effectively to supply gas for heating purposes; and it had been found by experience that one of the best ways of doing this was to let gas-stoves on hire. The Company proposed to deal in stoves, to sell them, and to let them, and to ask for power to repair them when this was needed. What the objection to this on the part of the Corporation was, he could not understand; but no doubt there was a sort of feeling that to a certain extent it was "treading on the toes" of the Brighton tradesmen. Of course, it was always a matter with which one dealt with respect, when it was urged that the capital of a joint-stock company was being used in competition with a small man who had really only his own capital to fall back upon; but he (Mr. Littler) thought he should be able to show that what the Company proposed would be a very great public benefit. They did not desire to get any unfair advantage; but they did desire to have the power of supplying stoves and fittings to their own customers. They also desired to be authorized to supply gas in bulk; and this, he thought, was the whole of the powers they proposed to exercise.

The Chairman inquired whether or not the Company proposed asking for powers with regard to gas-engines.

Mr. Littler said they did; but this was not of so much importance as the other. In order to enable them to carry on their business properly, they must have every assistance that could be given; and he intended to submit some striking figures when he came to deal with the petition of the Corporation.

The Chairman: As I understand, you ask for the following powers: Additional capital; money on loan; the right to use 5 acres of land for making gas, and to purchase 20 acres more; the right to serve an additional district; and the power to make and supply gas stoves, fittings, and engines?

Mr. Littler said this was so; and also power to sell gas in bulk to any local authority who desired to purchase it. The Corporation stated in their petition that the supply of gas within the borough and

the Company's existing district had of late been in many respects unsatisfactory; and they objected to the proposed extension of the limits to what would, as they were advised, be an unremunerative district. They submitted that, so far from this extension being sanctioned, if any further powers whatever were granted to the Company, stringent provision should be made for insuring the improvement and cheapening of the supply of gas within the borough and the existing district. The Company were at a loss to understand what was meant by the statement that the supply of gas was unsatisfactory. The gas was made at Portslade, and was tested at the works in Brighton—some miles away from the place of production; and the reports of the examiners would show that the standard of illuminating power had been fully maintained, as well as that of purity. In paragraph 5 of the petition, the Corporation objected to the sale of gas in bulk, on the ground that it would be practically extending indefinitely the district within which the Company might supply; this being, it was alleged, detrimental to the interests of the inhabitants of Brighton. Now, this was one of the commonest provisions in the world—being inserted in almost every Gas Bill; and he (Mr. Littler) thought it would have been to the interest of Brighton to have promoted it, because the gas was delivered under the most economical circumstances, without any leakage or loss. Everyone knew that, the larger a gas-producing concern was made, the cheaper the supply must become to all.

The CHAIRMAN pointed out that the Company were limited by the Bill to the "local authority of any district within or adjoining their limits."

Mr. LITTLER said that was so; but it was the ordinary form of clause. The Corporation further objected to the proposed increase of capital, on the ground that it was greatly in excess of the requirements. With regard to the provision made by the Bill for the sale by auction of the share capital intended to be raised, the Corporation submitted that this should be amended, and that arrangements should also be made for the public sale of any debenture stock which might be issued by the Company in the exercise of their borrowing powers. This was going entirely beyond the Standing Order; and he did not know of any instance in which a Parliamentary Committee had imposed this upon a company.

Mr. BAGGALLAY remarked that his friend need not labour this point, because the Corporation were not going to ask for the sale of the debenture stock by auction.

Mr. LITTLER said the Corporation also objected that the standard price the Company were at present authorized to charge for gas under their Act of 1881 was too high, and that it should be reduced; and that the illuminating power (14 candles) of the gas was much below that at which gas companies were usually compelled to supply it. They further said that no valid reason existed why the Company should be placed in this exceptionally favourable position; and that, if further powers were to be conferred upon them, provision should be made compelling them to supply gas of higher lighting power.

The CHAIRMAN: What is the standard price now?

Mr. LITTLER said 3s. 3d. per 1000 cubic feet, with an illuminating power of 14 candles. In 1881 the Company went to Parliament for authority to amalgamate with the Aldrington Company; and, as usual, they were opposed by the Brighton Corporation. On that occasion, the late Mr. Michael, who appeared for them, came into the Committee-room one morning, and stated that they had arrived at the heads of settlement with the Corporation; and he (Mr. Littler) thought it due to the Committee to read them at once. They were as follows:—

Brighton and Hove Gas Bill, 1881.—*Heads of Agreement.*

Clauses to be inserted in Bill providing for standard price to be 3s. 3d. per 1000 cubic feet, to come into operation within three calendar months after the amalgamation is confirmed by Order in Council. Also a sliding scale according to the terms in recent legislation. On the completion of the amalgamation, the Brighton and Hove Company to cease to manufacture gas and residual products at the works of the Brighton Company within a period of ten years after such completion. In case of amalgamation, the Acts relating to the Brighton and Hove Company are to apply to the United Company. These terms being agreed to and embodied in the Bill, opposition of the Corporation of Brighton to the Bill to be withdrawn.

This was a bargain arrived at with regard to the standard price and illuminating power, although the latter was not mentioned. It was the same in the case of both Companies; and therefore it was not disturbed. On the strength of this, the Company then issued a large amount of capital, which was sold at high premiums; the buyers, of course, taking into consideration all the conditions—the two principal ones being the standard price and the illuminating power of the gas. The whole of this capital would suffer if any application were now entertained in reference to either. The Company had the usual power to form a reserve fund; but they had been anxious to keep the dividends equal, and also, if possible, not to increase the price of the gas. The consequence of this was that the profits earned last year came to £33,399; but the amount required to pay the interest on borrowed money and dividends on the capital was £45,887—leaving a deficiency of £12,488. If the illuminating power were increased by one candle, the profits would be reduced by no less than £6800; and, of course, if they lowered the standard price, it became a mere matter of calculation of the number of pennies by which it was reduced to see how far they would go on bringing down the dividend until they had nothing at all.

The CHAIRMAN asked if 14 candles was not a very low standard of illuminating power.

Mr. LITTLER replied that he thought it was not. In recent legislation, 15 candles had been given; and in Lancashire, in some cases, 20 candles. But then there were cannel beds near. If the Corporation required 15 candles, the standard price would have to be increased, because the present one did not allow of the Company supplying even 14-candle gas. The standard had been agreed to upon the understanding that the gas was to be of 14-candle power; and if this was raised, it followed, as a matter of justice, that the price must also be increased.

The CHAIRMAN said his impression was that the standard in Manchester was about 18 candles; and the price there was not so high as at Brighton.

Mr. LITTLER said the illuminating power was not fixed in Manchester, the supply being in the hands of the Corporation; but the gas supplied was 19¼-candle power.

The CHAIRMAN asked what was the population within the limits of supply of the Brighton Company.

Mr. LITTLER said it was 156,697. At Leicester, the illuminating power was 14 candles; at Nottingham, 12; at Oldham, 14; at Bath, 14; at Bristol, 14½; at Plymouth, 14; and at Portsea, 14. The Brighton Company had to use mainly Durham coal; and it was very difficult to get from it, without admixture with something else, anything higher than between 14 and 15 candle gas. They were obliged to supply gas half a candle higher than the prescribed limit, in order to avoid being subjected to penalty. Gas of from 14 to 15 candle power was the very best for heating purposes. With regard to the statement of the Corporation that there was room for further economy in the production of gas, and that by the exercise of it a substantial reduction in the standard price and increase in the illuminating power might be given without loss to the Company, the Committee would hear from eminent engineers that the gas was very well made, and most economically supplied. Paragraph 12 of the petition was as follows:—

Provision is sought to be made, by clauses 23, 24, and 25 of the Bill, with respect to insurance and reserve funds, and the carrying forward of excess profits; and your petitioners submit that such provisions are unsatisfactory. Very similar provisions are contained in the Company's Act of 1881; and your petitioners submit that, if any further powers are conferred upon the Company with respect to these matters, those provisions should be repealed, and that further provision is needed for the protection of the consumers against the accumulation of undivided balances in the hands of the Company, and for facilitating their obtaining a reduction of the price charged for gas when the full dividends of the Company are being paid.

Now, this seemed to proceed on an absolute misapprehension. The Corporation were being advised by Mr. Silverthorne, who entertained opinions very dissimilar to those held by his professional brethren. This view was one which verged on the absurd; because, if the Company had no undivided profits and no reserve left to protect them against accidents and strikes, the result would be that the price would be fluctuating up and down. Sometimes they would have gas at a moderate rate, and the next year at an extremely high one. For example, if the Company had not taken from their undivided profits this year the difference between the £45,887 and the £33,399, the price of gas must have been raised. The Company put by, in prosperous years, a sum which was admitted to be profit. This was called "undivided profit;" and when a season of trouble came, this money was resorted to, in order to keep up the dividend without in the slightest degree affecting the price of gas.

The CHAIRMAN asked what was the standard price of the gas.

Mr. LITTLER replied 3s. 3d.

The CHAIRMAN: How much higher could you go?

Mr. LITTLER said that, when they charged 3s. 3d., they were entitled to pay 10 per cent. on the earlier stocks, 7 per cent. on some of the others, and 6 per cent. upon the preference stocks.

The CHAIRMAN: Can you go higher than 3s. 3d.?

Mr. LITTLER said they could do so by reducing the dividend. Supposing they were to go up from 3s. 3d. to 4s., they would have to take 2¼ per cent. off the dividend—¼ per cent. for each penny; but for every penny they went down, the shareholders were rewarded by getting an extra ¼ per cent. dividend. One of the best tests of economy in management was the amount of capital invested for each million cubic feet of gas sold. In the year 1878 (the year before the Company last came to Parliament), the capital stood at £826 per million. Now, however, it was only £634; thereby showing that, while the Company had been reducing the price of gas, they had also been exercising the wisest economy in the way of conducting their works. The Committee would hear that the works were well constructed; and he could not help thinking that, when the Corporation of Brighton had heard the real facts of the case, they would withdraw their opposition.

The following witnesses were then called in support of the Bill:—

Mr. *J. Cash*, M.Inst.C.E., examined by Mr. SAUNDERS, said he had been Engineer and General Manager of the Company for seven years; having for the previous twenty-four years been Assistant Engineer. The Company was incorporated in 1825 under the provisions of a trust deed. Subsequently they obtained nine Acts of Parliament between 1839 and 1881. Under the last Act, the Company were amalgamated with the Brighton Gaslight and Coke Company. They also acquired the interests of a small concern—the Aldrington Gas Company—which had been authorized some years previously, but had never actually started works. The whole supply of gas in Brighton was under the control of the present Company. Under the terms arranged with the Corporation in 1881, the standard price was to be 3s. 3d. per 1000 cubic feet. The maximum price was then 3s. 6d. There was no sliding scale; but it was agreed that, within three months of the amalgamation, the price should be reduced 3d. per 1000 cubic feet, and the provisions of the sliding scale were then to apply. At that time, this was considered to be a fair arrangement between the Company and the Corporation. Another term was that the Company should, within ten years from the passing of the Act, cease to manufacture gas and residual products at the Black Rock and Hove works. At both these places, the land was now only used for storeage purposes. The authorized capital of the Company was £495,000. At the end of last year, £492,940 had been raised by shares, and by premiums upon the capital issued; leaving only £2060 unissued. Since that date the remaining capital had been called up; so that now the whole of the share capital had been raised. No interest was paid on the premium capital. At the end of 1892, the loan capital stood at £95,000 authorized, £76,200 raised, and £18,800 remaining to be borrowed. The latter sum would be paid up by the 1st of April; so that the capital powers were quite exhausted. To extend the works and to meet the current demand for gas, it was necessary to obtain powers for raising further capital. The Company had £220,000 of original shares, bearing 10 per cent. dividend; £225,000 of "A" shares, carrying 7 per cent.; and £50,000 of "B" preference shares, carrying 6 per cent.; and, in addition, a loan capital of £95,000. A portion of this was issued at 5 per cent., and the remainder at 4 per cent. There was a great demand for gas outside the present limits of supply—namely, in the parishes of Hangleton,

West Blatchington, Poynings, and New Timber. The Corporation of Brighton did not oppose the extension into Hangleton and West Blatchington; but they did to Poynings and New Timber. In the latter place, there had lately been a great increase of buildings; the Devil's Dyke being within the parish of Poynings. There was no opposition to this extension on the part of the people of these parishes. He did not think it would lead to an increase in the charge for gas in Brighton itself; nor was there any possibility, with the sliding scale, of the Company doing anything which would have the effect of raising the price. Another power the Company sought was to be enabled to manufacture gas upon 5 acres of land scheduled in the Bill; and they also proposed to purchase by agreement not exceeding 20 acres besides. Their object was that, when land came into the market at a moderate figure, and they saw they could make an advantageous purchase, they could exercise the power, and afterwards, if necessary, obtain authority for the construction of works upon it. It was usual for gas companies to have power to purchase land. The Company had it in their Act of 1879, and had exercised it. It would be very advantageous to have the power sought in regard to gas stoves, fittings, &c. It was not the intention of the Company to make gas-engines. The capital had, in his opinion, been economically and judiciously expended, There had been a considerable augmentation of the number of inhabited houses in the district during the last three years; and at the present time there was a larger demand for the extension of mains than had been the case for a long time. The Company were putting themselves into a position to meet the requirements of the labouring classes. They fitted up the houses with gas, from the main to the burners, at a nominal rent for the fittings; the rents being collected in small sums weekly. From these facilities, the Company anticipated a progressive increase in the demand for gas. During the last five years, it had been in excess of the average rate previously. The extensions of mains sought were chiefly in the outskirts of Brighton. Taking the new share capital at £300,000, and borrowing powers for £75,000, the Company would have an increase of £375,000 on the existing capital of £590,000, or an increase of about 65 per cent. Assuming the rate of increase in the consumption of gas to continue, the £375,000 would, if judiciously expended, last between fourteen and fifteen years. The share capital had been offered to the public by auction; and, had the standard price been 2s. 9d. instead of 3s. 3d., the amount presumably paid would have been very much less. The result would have been that the Company and the consumers would have had a smaller sum carried to the credit of the capital account. Up to Dec. 31 last, the sum of £35,440 had been so credited. The 7 per cent. shares were sold at a premium of rather over 50 per cent. Of the additional profits which had been made by the Company since the date of the adoption of the sliding scale in 1881, the shareholders had one-fourth and the consumers three-fourths; and the benefit to the latter had amounted to more than £100,000. In the majority of Acts of Parliament regulating gas companies in England, the standard of 14 candles was adopted. The Company objected to have the illuminating power raised, as part of the compact entered into between them and the Corporation in 1881 was that the price should be 3s. 3d. with a 14-candle gas. To increase that to 15 candles would cost the Company 1¾d. per 1000 cubic feet. The price charged now was 2s. 9d.; but in 1882 this was not sufficient to earn the amount required for the dividend—the Company being £12,488 out of pocket. This had to be taken out of the undivided profit account. The Company would then have been justified in charging a higher price.

The CHAIRMAN: As I understand, the amount of reserve—£56,000 odd, arises before you take the money to pay the dividend?

Witness: That is the amount which belonged to the shareholders of the old Company before the amalgamation, and which has been invested from time to time.

Cross-examined by Mr. CRIPPS: The population of Poynings and New Timber was very small. The Company had no intention whatever of putting unremunerative mains in these districts; and they would not do so unless there was sufficient demand for gas. It was quite within the bounds of probability that in three or four years a small town would start up at what was called the Dyke. At the present time, taking matters as they were, the Company would not be justified in laying mains; and they did not intend doing so. The Corporation might very well trust the Company in this matter. The Company had no unexercised powers with regard to taking land apart from those sought by the present Bill. They had no vacant land.

The CHAIRMAN: As I understand, they have no land, no powers, and no money.

Mr. LITTLER: That is an exact summary of my speech.

Cross-examination continued: There was considerable difficulty in obtaining land in the district of Brighton and Hove, and in the outlying districts; and when it came into the market, it would be to the Company's advantage to be able to obtain a piece that might be sold at a remunerative price. It might be wanted for the extension of the works, or be used for storing residual products, pipes, &c. The whole of the space at Portslade was now occupied.

The CHAIRMAN inquired if it was suggested, on behalf of the Corporation, that the Company wanted land for purposes of speculation.

Mr. CRIPPS said he did not know why they wanted it; but what the Corporation wished to be protected against was that no land should be acquired within a certain distance of the borough of Brighton, to be used for the storeage of gas or of any residual products. The witness had just said the Company might buy the 20 acres of land and store residuals upon it. It was very important, in a town like Brighton, that the Corporation should be guaranteed with reference to the user of the land; and, if they were guaranteed, they had no further objection to the scheme.

Cross-examination continued: The Company had recently raised £18,800 of fresh capital. The money had not yet been actually received; but when paid it would form part of the general funds of the Company for enlarging the works. They had recently carried out extensive works, in respect of which they had become liable for certain expenditure. Between £40,000 and £45,000 was required as working expenses. They proposed to have capital powers to the extent of £375,000, which included premiums and debenture stock. This would last until the year 1907, calculated upon the very moderate increase of 4 per cent. in the business. The standard price of 3s. 3d. was fixed in 1881. By reducing the price 1d. per 1000 cubic feet, the income of the Company would be diminished by £3750. This represented the consumers' share; and to it must be added the Company's share, amounting to £1112.

Re-examined by Mr. LITTLER: The Company would not put down a new main until they were satisfied that there was some chance of it being remunerative. Assuming the ordinary rate of progress, it was pretty clear that, by the expiration of fourteen years, the Company would have come to the end of its capital. There was not the slightest intention to buy land in any part of Brighton that would not be of use to the works.

By the CHAIRMAN: A sum of £12,000 had been taken this year from the profits to make up the dividend. To a certain extent this had been done in other years. The special loss this year had been occasioned by the increased cost of coal and labour. The Company had protected themselves in the previous year by good contracts; so that they had tided over the difficulty where many others had had to increase their prices.

The CHAIRMAN: Have the Corporation asked for any particular candle power?

Mr. BAGGALLAY: Yes; 15½ candles.

The CHAIRMAN: What would that extra 1½-candle power cost the Company?

Witness: Roughly, £10,000 per annum on the present make, or equal to 3d. per 1000 cubic feet. To give it we should have to raise the price to that extent, and this would reduce the dividend ¾ per cent.; and if we preserved the price, we should have no money to meet the deficit.

Mr. *H. E. Jones*, M.Inst.C.E., examined by Mr. FREEMAN, said he was well acquainted with the district and works of the Company. He had carefully considered the Bill, and the petition presented against it by the Corporation; and, for the purpose of seeing how the facts lay, he had gone into the accounts of the Company for the past five years. Speaking as an expert, he considered the provisions of the Bill fair and reasonable. The effect would be to benefit the future consumers of gas in Brighton. The operation of the sliding scale and the auction clauses must inure to the advantage of the consumers. It was absolutely necessary for the Company to extend their works; and for this they must have additional capital. During the last five years, the sale of gas had risen from 736½ to 897½ million cubic feet; being an increase of nearly 22 per cent., or equal to a compound rate of increase of 4·05 per cent. At this rate the business of the Company would double itself in about seventeen years. The Company at present did not let out gas-stoves on hire; but it was important to the public interest that they should do so. The development of the use of gas in stoves was one of the most striking features of the gas industry at the present time. With this addition, the business would about double itself in fourteen years. In his opinion, the amount of capital asked for was fair and reasonable. It was also very desirable that the Company should have power to acquire additional land. With regard to the raising of the illuminating power, he considered this was only another way of disturbing the present compact. The march of invention, during the last four or five years, had produced a large number of burners which enabled one to get a much higher lighting power from gas than the standard one by which it was tested. It had been demonstrated, beyond contradiction, that the best illuminating value was obtained from a ton of coal when gas of 14 or 14½ candle power was extracted from it. If gas of much more than 14½ candles was taken from Durham coal, part of the light-giving properties of the coal were lost; so that, as a matter of physical economy, it was better to get from the raw material the most gas and the highest illuminating power together. But in order to get anything beyond 14 candles, it was necessary to employ some foreign matter such as cannel, which was very expensive, and was becoming very scarce. He had made experiments in raising the illuminating value of gas from 14 to 16 candles; and he had obtained 16·33-candle power with the consumption of 14·15-candle gas by burning another ½ cubic foot upon the 5 feet—burning 5½ instead of 5 cubic feet. This was done by turning the burners fully open; and it was equal to an additional consumption of 44·8 cubic feet per 1000, which, at 2s. 9d. per 1000 feet, would increase the expenditure by 1·48d. to obtain 15-candle gas. The cheapest method of enriching gas by cannel coal cost 1·74d. per candle. A great deal of gas was now used for heating and cooking purposes. To all intents and purposes, 14-candle gas was as good as any other; and it was a pity to make a rich, expensive gas from which consumers could not, in burning, derive any corresponding benefit. He considered the Company had been extremely well administered; the works being of a modern and substantial character. He did not think the term "extravagantly managed" applied in any way to them. Having regard to all the circumstances, the price charged for gas was extremely moderate.

Cross-examined by Mr. BAGGALLAY: The Company with which he was connected—the Commercial—supplied gas of 16-candle power; but at Hastings it was 15 candles. The price was 4s.; and, having this in view, he did not think 15 candles was too much to ask for there. The *raison d'être* of a gas company used to be to supply light only; but now it was to supply light, fuel, and power. Undoubtedly, the primary object was to supply light; the secondary one, to sell gas for heating and cooking purposes. The lighting property of the gas should not be sacrificed in the interests of heating; but it was possible to pay too dearly for illuminating power, as was done at Hastings.

Re-examined by Mr. FREEMAN: The Corporation sought to alter the price and the illuminating power of the gas adversely to the Company. He had never known of a case where a gas company, working under the sliding scale, had had such terms as these put upon them.

Thursday, March 23.

Mr. *E. H. Stevenson*, M.Inst.C.E., examined by Mr. SAUNDERS, said he had inspected the Company's works specially with a view to the present inquiry, and had read the Bill and the petition against it. The works, which were very well designed and solidly constructed, were capable of producing a daily output of about 4,000,000 cubic feet of gas. The new works, when completed, would enable the

Company to manufacture 6,627,000 cubic feet. This included a reserve power which ought not to be used, and, therefore, he deducted from 10 to 15 per cent.; so that the real strength of the works when completed would only be about 6,000,000 cubic feet. The storeage capacity of the two holder stations at Hove and Black Rock amounted to 4,650,000 cubic feet. This was somewhat small; and he should advise the erection of a holder of not less than 2,000,000 cubic feet—bringing the quantity up to 6,650,000 cubic feet. The Company could not put up a holder exactly to suit the present requirements; but they must build it for the future, and the storeage capacity should be put up to the needs of the works. It was advisable to have slightly more than one day's production in reserve. The whole of the gas was at present pumped from Portslade to the manufacturing works at Black Rock and Hove. This somewhat affected the illuminating power; in fact, it came out, in the case of the Bristol Gas Company, that it made a difference of fully half a candle. He agreed with Mr. Cash in thinking that the increase might be put at 4 per cent. It was true that it was only 3·7 per cent. during the years from 1883 to 1891; but one year was abnormal—there being practically no increase at all. If the Company obtained power to let stoves on hire, the business would certainly grow at the rate of more than 4 per cent. A great number of people would not burn gas for heating and cooking purposes unless they could hire stoves; and, if the Company had the power to let them, the annual increase would be certainly 5 per cent., if not more. As the Corporation were competing with the Company by supplying electric light, it was desirable that the Company should be able to supply consumers with the best stoves and burners.

Mr. CRIPPS said the Company had obviously no power to manufacture these things. The Corporation were willing to give power to manufacture generally, which the Company had not now, excluding these particular items.

The CHAIRMAN: You do not object to their supplying them?

Mr. CRIPPS said they had the power to do that in their Act of 1886.

The CHAIRMAN: Then that point is narrowed down to whether they shall have the right of manufacturing stoves and burners.

Witness said the Company would not manufacture these articles, because they could buy them so much more cheaply. The point really was the selling. They wished to supply at as near cost price as possible.

The CHAIRMAN: Would you have any objection to taking out the word "manufacture"?

Mr. SAUNDERS said he should not, as he did not think the power would ever be exercised.

Mr. CRIPPS said, if the word were taken out, he need not trouble the Committee any further on that point.

Examination continued: He considered the amount of new capital asked for would be required, having regard to the expenditure which would be necessary for extending the works.

The CHAIRMAN asked if there was any great nuisance occasioned to the neighbourhood from the storing of tar or ammoniacal liquor.

Witness said it depended upon how it was done; but no gas company would convey tar and liquor from their works, and store them upon another piece of land. They did not do this unless they were going to deal with them there, as it would simply be waste of money.

Mr. SAUNDERS said the Company did not want the power of storing residual products, except coke, within Brighton, or, he might say, within half a mile of Brighton. What they did want was not to have the law strengthened with regard to the possible storeage of gas within the limits mentioned by the Act. The Act provided that, if the Company could get the consent of everyone within 300 yards, practically they might store; and they did not wish to have this varied by any restriction.

The CHAIRMAN said the Committee had not considered the matter fully; but he did not think they would be prepared to permit a gas-holder within 300 yards of Hove, even with the consent of the Corporation of Brighton and the Improvement Commissioners of Hove.

Mr. SAUNDERS observed that this was really strengthening the law. He was quite willing that there should be an absolute restriction to within half a mile from Brighton. As to Hove, it was content with the general law.

The CHAIRMAN said it was evident they could not come to an agreement upon the point; and therefore, they had better proceed with the examination.

Examination continued: Quite apart from the sliding scale, he considered there were advantages in gas of 14-candle power when the Company had to provide it for both lighting and heating purposes. Taking into account the fact that the sliding scale had been arranged with an agreed illuminating power of 14 candles, he thought it would be an injustice to interfere with it without also raising the standard price. It would be an injustice to the shareholders, as their dividends would at once fall, because the Company would have to increase their charge for gas in order to pay their way. In the case of a company having a standard price and illuminating power fixed by Parliament, if either of these were altered to the detriment of the company—that was to say, the standard price lowered or the illuminating power raised—it would have the effect of upsetting the market for gas shares everywhere. [In support of this statement, witness referred to the case of the South Metropolitan Gas Company's Bill in 1881, when the Metropolitan Board of Works opposed, and asked that the standard price should be lowered.] If the Brighton Company had to supply 15½-candle gas, for which the Corporation asked, the cost would be increased from 2d. to 3d. per 1000 cubic feet.

Cross-examined by Mr. CRIPPS: When the third section of the works, which was now being completed, was opened, the daily make of gas would be 6,627,000 cubic feet, from which he should deduct 10 per cent. as a stand-by, but not for leakage. In all gas-works there should be a certain reserve power. The additional capital was required partly to finish the existing works, and partly for others.

Mr. CRIPPS: When the Company have completed the present works, there will be left a sufficient sum to last for a very considerable time.

The CHAIRMAN said, as far as he understood the figures given, there were not a million cubic feet more gas to be got out of the works.

Witness said the retorts which were not in use last winter would make 960,000 cubic feet of gas.

Cross-examination continued: Witness gave evidence on behalf of the Local Authority in the case of the Southend Gas Bill last year, and told the Committee on the Bill that it would be fair to alter the illuminating-power from 14 to 16 candles; and they gave 15 candles. That Company, however, had neither a sliding scale nor a standard price; and the Committee thought they gave them a standard sufficient to pay for the increase. Each case must stand upon its own basis; and he thought in the present instance they were fairly asking for what ought to be always given. The first point in connection with gas was to look at it as an illuminant; its use for heating purposes was a secondary matter.

The CHAIRMAN: Do you consider that, where there is electric light supplied by a corporation, the use of gas in the future will, in reality, increase in the heating direction?

Witness: I believe in the course of time it will increase only in that direction, not in lighting. The poorer people will use it for lighting, because in the winter time it gives out heat as well; and they cannot afford to do without that. But the well-to-do classes, as well as the hotel and large shop-keepers—those people who have been the principal consumers of gas in the past—will adopt the electric light.

We understand that the gas used for cooking is about 1 per cent. of that employed for lighting. Do you imagine it will ever get to a very considerable proportion?—I do, indeed. In the next twelve or fourteen years, I think it will be considerably more than 10 per cent. Brighton is a place where, if gas-stoves were allowed, I believe they would be very largely used.

Re-examined by Mr. SAUNDERS, witness said that application was frequently made, when gas companies were before Parliament, for an increase in the illuminating power and a reduction in the price of gas; and where it was fairly asked for, it should be granted. But, with regard to reducing the price, he said he thought the opposition in the present case would fail to bring any instance where the standard had ever been lowered. One of the principles of fixing the sliding scale was to afford an inducement to a company to reduce the price; and it had had this tendency. When a company had brought down the price by effecting economies, it would not be fair that the standard should be altered against them for the purpose of getting a still lower rate. When the standard was fixed, he considered it fixed for ever.

Mr. *Corbet Woodall*, M.Inst.C.E., examined by Mr. FREEMAN, said he considered the Company were thoroughly justified in asking for increased powers. In his opinion, there was nothing in the Bill prejudicial to the consumers. It would be to their advantage that the proposed districts should be included within the limits of supply.

The CHAIRMAN asked whether the Corporation opposed the extension of the Company's district.

Mr. CRIPPS said he only opposed it with regard to the two places where the extension would be costly, as there would be no real demand for gas—viz., Poynings and New Timber.

The CHAIRMAN said the Committee were at present in favour of allowing a supply in these districts.

Mr. CRIPPS said that after this intimation, he would not trouble the Committee upon it.

The CHAIRMAN said he noticed that the last witness had not been examined or cross-examined with regard to the selling of gas in bulk. Was there any real objection to this?

Mr. CRIPPS said the only question upon the point was that the Company should not supply on better terms outside than inside their district. Of course, if they did, the Corporation might suffer injury.

Examination continued: It would be absolute folly to oppose the sale of gas in bulk on the part of the Brighton or any other gas company. They would only sell it for the purpose of making profit; and any profit which was made would inure to the advantage of the consumers. The site upon which the present works were built was very well chosen. The land upon which the Company were authorized to erect their works was practically filled up, though the demand for gas continued to increase. In the ten years from 1882 to 1892, there had been an advance of 257 million cubic feet upon the gross quantity made, and about 1⅓ million cubic feet in the maximum quantity sent out in one day. In other words, the total quantity of gas sold had advanced 40 per cent.; and the maximum day's output, 33 per cent. Considering the rate of increase, he thought the Company had only room to meet it for three years; and upon this fact alone they were bound, as prudent men, to ask for further powers. With regard to the additional land, he could see no possible object in limiting the Company with respect to the quantity they should hold for the purpose of manufacturing gas in such a neighbourhood as that in which they had their works. In the ten years to which he had referred, the Company had spent £136,147 on capital account; being an increase of 30 per cent. while that of the gas sold was 40 per cent. This showed that the money was being spent fairly and prudently. At the present time the capital powers of the Company were exhausted. There was one circumstance in connection with the new capital to which he might refer—viz., that while the average rate of interest paid upon the present capital was 8·3 per cent., involving a charge for dividend of more than 1s. per 1000 cubic feet, the new capital would only involve a charge of about 4·8 per cent., or 7½d. per 1000 cubic feet. He was intimately acquainted with the operation of the sliding scale; and he considered that the consumers were amply protected by it, as it was immaterial to them how much the dividend was increased, because they gained at the rate of four to one for every rise. It was of the first importance, in fixing the standard price, that it should be done fairly; and he should view with the greatest concern any alteration in it after it had been once settled.

Mr. FREEMAN: Have you, in your experience, ever known a case in which the standard price has been reduced, and at the same time the illuminating power increased, without any equivalent?

Witness: I have not known either one or the other. It is fair to say that the opportunities have been few, because the number of sliding-scale companies that have returned to Parliament have necessarily been limited—the sliding scale having only been introduced a comparatively short time since.

The CHAIRMAN: Do you go so far as to say that, when once the sliding scale has been adopted, you cannot alter practically either the price or the illuminating power of the gas?

Witness: I say emphatically, with regard to the price, that it would be a gross injustice to alter it.

Do you say that, if a gas company have once adopted a certain candle power, the inhabitants of the neighbourhood are never to have an increased power?—I should be sorry to say that; but I do regard the illuminating power as one element in the bargain. I think it is quite equivalent to lowering the price of gas if you increase the cost of the article the Company have to sell. If the Company find the demand in Brighton is for gas of a higher quality, they must supply it, or run the risk of losing their business. Here the Corporation are not simply petitioning against the Bill—they are rival traders; and naturally it would be to their interest to raise the price of gas to the consumers. But, on the other hand, if the consumers require a brighter light than they get from the 14½-candle gas, all they have to do is to say to the Company: "If you will not supply us with a good quality, we must go to the electric light."

Examination continued: In the case of Brighton, he thought 14-candle gas was sufficient; it being used for cooking as well as for lighting purposes. It would be a pity to raise the quality of the gas where the increased illuminating power was of little value. If it was raised from 14 to 15 candles, the standard price ought to be advanced at the same time; but no such proposal was made by the Corporation. It was simply to raise the illuminating power and reduce the standard price; and this seemed to him very unreasonable.

Cross-examined by Mr. CRIPPS: He did not suggest that it was of advantage to the consumer to have gas of low illuminating power, though for some purposes it clearly was, because where he wanted heat, and not light, it was desirable that he should be able to buy it as cheaply as possible; and he was not at all sure that, even for lighting, he did not get rather better money's worth with the lower quality of gas. He should never advise either a company or a corporation to go to Parliament for a low quality of gas. The price and quality would go together. In the present case, the standard was low. Gas of 14-candle power was a fair standard for Brighton; but if the Company were applying now for the first time to be put under the sliding scale, he should advise them to put 15 candles in their Bill.

This closed the case on behalf of the promoters. That for the opponents, and the report of the concluding proceedings on the Bill, will be given next week.

Johannesburg Lighting Company, Limited.—The ordinary general meeting of this Company was held on Thursday last, at Winchester House, Old Broad Street, E.C.; Mr. W. Garland Soper presiding. In moving the adoption of the report, the principal portions of which were given in the JOURNAL last week, the Chairman expressed the opinion that the assets in the balance-sheet were entered below their value. Although the revenue account covered a period of ten months, lighting had not been supplied for the whole of this time. As a matter of account, there appeared to be a loss; but the Directors considered this was more than covered as a matter of value. The expenses had been heavy; but, as the consumption of electricity and gas increased, the relative proportion of expense to revenue ought materially to diminish. In existing circumstances, the Company were unable to meet the present and increasing demands upon them both for gas and electricity. In addition to the town itself, they had the districts of Doornfontein and Jeppe's Town, which, by the terms of their contract, they had to supply with light at once. To meet the demands upon them, more capital was needed; and they would require to erect a second gasholder and tank, to extend the mains, and to provide further plant for the electric light. Mr. W. M. Farmer seconded the motion, which was adopted. The Chairman afterwards proposed a resolution approving the Directors' proposal to borrow a sum not exceeding £40,000 by debentures. Mr. S. H. Hewitt seconded the motion, which was carried.

The Bangor City Council and their Gas Manager.—Last Wednesday the Bangor City Council had a prolonged discussion arising out of a proposal of the Gas Committee to spend a small sum in making an experiment at the gas-works. It was strongly opposed by certain members of the Council, who questioned very much the capability of the Gas Manager (Mr. J. Smith). It seems that at the previous meeting, the following recommendation of the Committee was rejected: "That the suggestions contained in the Gas Manager's report be carried out, and that the new iron retort and the necessary apparatus for the purpose of carbonizing tar and converting it into gas be obtained and erected at a cost of £60 or £70." The Committee now reaffirmed this recommendation, and again asked the Council to accept it. In moving its adoption, Mr. J. E. Roberts dwelt at considerable length on the improvements made at the works by Mr. Smith, and urged that he should be allowed to carry out the experiment (which, as now proposed, would only cost about £25), as he was undoubtedly a capable man. The motion was seconded by Alderman Jones; and then Mr. T. G. Williams opposed it—contending that in times past Mr. Smith had failed to fulfil certain promises made by him in respect to improvements. It was moved by Mr. Davies, and seconded, that the decision of the Council at the last meeting be adhered to. The recommendation having been supported by Mr. H. Lewis, who asserted that the opposition was not so much against the proposed experiment as against the Gas Manager, a great deal of acrimonious talk was indulged in. The Mayor (Mr. W. A. Dew) went into a detailed statement of the work done by Mr. Smith in the capacity of Gas Manager—work which, he held, had greatly benefited the town during the last nineteen years—and concluded with an earnest appeal to the Council to vote in such a manner as to show that they appreciated and had confidence in Mr. Smith, and in his assurances that the £25 proposed to be spent on this experiment would be well laid out. If, on the other hand, they had no confidence in the Manager, it was their duty to the ratepayers to propose a vote of want of confidence in him. Mr. Davies then withdrew his amendment, but maintained that the Gas Committee had acted in a very high-handed way. Permission to withdraw the amendment, however, was, on a division, refused by a large majority. It was then put to the vote and defeated; and the Committee's recommendation was carried.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Meeting of this Company was held on the 30th ult.—Mr. E. FOTTRELL, J.P., in the chair.

The SECRETARY and GENERAL MANAGER (Mr. W. F. Cotton) read the notice convening the meeting; and the Directors' report and the statement of accounts, which were summarized in the JOURNAL on the 28th ult., were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said he had the satisfaction of informing the shareholders that the consumption of gas was increasing. During the past half year, they had delivered 19 million cubic feet of gas in excess of the corresponding period of 1891. This was extremely satisfactory, seeing that there were other illuminants in the field. Much of this increase had been caused by the use of gas engines and stoves. In the six months, 503 cooking, heating, and boiling stoves were sold; and the number of engines was also largely on the increase, now amounting to 230. During the half year they had also obtained 131 new customers. In order to supply nearly 19 million cubic feet of gas extra, they had had to use an additional 3320 tons of coal. He was very happy to say that, with regard to the executive work conducted by their engineers and assistants, they had so arranged that the expenses at the works were not increasing—in fact, they had kept them under the *pro ratâ* figures of the corresponding half of the preceding year. That was a very satisfactory result, and showed that the more they increased the quantity of the gas delivered, the more profits they were likely to make. There was one little blot which he could not help alluding to with great regret, and that was the price of the residual products, the receipts from which had been less by £6501 than in the corresponding period of last year. But they could not do impossibilities; they could not force the sale of coke when people did not want it. Then as regarded tar, sulphate of ammonia, and ammoniacal liquor, these entirely depended on the state of the commercial world. He had looked over the accounts of several companies; and they were all in the same boat as themselves. Were it not for the great deficit in the receipts from residuals, they would be in a very satisfactory condition; but those Companies were far and away worse off than the Alliance. However, notwithstanding the £6500 reduction on residuals, he looked forward strongly in the hope that, with improved trade, they would be able to combat this, and redeem their position before long. Then respecting coal, the price of cannel had been very high. They were obliged to use more of it in proportion than other companies; the illuminating power of their gas being measured by a burner which was hardly known elsewhere, and which made the gas of a much higher standard than it was computed to be in other places. It was satisfactory to note that, whereas the cost of 6382 tons of soft and cannel coal used for carbonization was 18s. o½d. per ton in 1891, in the corresponding period of the past year it was 17s. 11¼d.; showing that the price was decreasing, and giving hope that the Directors might be able to make better contracts in the future. Under these circumstances, he did not feel at all dissatisfied. As he said before, there was one little blot—the sale of residuals. They were doing their best to remedy this, and they hoped in the current half year to show an improvement. In the meantime, they were keeping all the charges at the lowest possible figure in respect to the works—of course, taking proper care that efficiency was maintained. The working in the office—the administrative department—had also been kept low; great watchfulness being exercised by the Committee, Secretary, and officers to keep all the expenses as low as possible. The outlay in that department bore favourable comparison with that of the previous year; being less in comparison with the quantity of gas supplied. He had nothing further to say, but that he looked forward to good times when they would be able to add to the reserve fund, upon which they had had to draw.

Mr. J. R. WIGHAM seconded the motion, which was carried.

On the proposition of the CHAIRMAN, seconded by Mr. MAURICE BROOKS, D.L., dividends at the rates of 10½ and 7½ per cent. per annum on the respective shares were declared.

The retiring Directors and Auditors having been re-elected, votes of thanks were passed to the Chairman and Directors, as well as to the Secretary and staff; and the proceedings then terminated.

DARLINGTON CORPORATION GAS SUPPLY.

Reduction in the Price of Gas.

At the Meeting of the Darlington Town Council last Thursday, Alderman Walker moved the confirmation of the minutes of the Gas Committee, which stated that the profit on the past year, with the profit balance brought forward, amounted to £3050, of which £2500 was recommended to be handed over to the general district fund. The Committee also proposed that the price of gas to all consumers, except the North-Eastern Railway Company, should be reduced 2d. per 1000 cubic feet. He said he thought he had the right to claim for the Committee that they had piloted the ship through many breakers, and had arrived at unquestionably the best haven they had ever known, so far as profit was concerned. During the coal strike and the period when it gave them great concern to know whether or not they could get coals, and when they had to accept them from almost any quarter, they had managed, owing to the manipulation of their Manager, not only to keep up the illuminating power to its normal condition (16½ candles), but also to give general satisfaction. The result of the year's working was that they had a profit of £2699, of which they handed over £2500 in relief of the rates. They would see that the profit for 1892 was double that of the previous year. The Committee therefore thought, and agreed unanimously, that the time had come when they ought to give some relief to the consumers. It seemed to him that, as one-third of the residents in the town did not consume any gas, that the two-thirds who did consume gas ought to have the lion's share of any profit. The minutes were unanimously agreed to.

COMMERCIAL GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company which, with the accounts for the half year ending Dec. 31 last, will be presented at the ordinary general meeting next Thursday:—

The Directors submit the accounts for the half year ended Dec. 31, 1892. The revenue account shows a net profit for the half year of £44,441 12s. 1d.; making, with £746 9s. 3d. received for interest, £45,188 1s. 4d. Deducting therefrom £3685 12s. 9d. for interest on debenture stock, there remains standing to the credit of the net revenue account a balance of £41,502 8s. 7d. available for dividend. The Directors recommend the payment of dividends at the rates of £12 10s. per cent. per annum upon the old stock of the Company, and of £9 10s. per cent. per annum upon the new stock, both less income-tax. The amount of £710 1s. 5d. by which the profits of the Company are insufficient to pay the dividends will be taken out of the reserve fund. The following Directors, Messrs. J. B. Gill, R. Jones, and F. Farnan, retire by rotation; and, being eligible, offer themselves for re-election. Mr. J. Haigh, one of the Auditors, will also go out of office by rotation; and, being eligible, offers himself for re-election.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as on Dec. 31, 1891—viz., £715,000 paid up out of a total of £830,000 authorized. The statement of loan capital (No. 2) shows that £165,000 has been borrowed, out of £300,000 authorized. The capital account (No. 3) shows receipts to the amount of £880,000, of which the sum of £4238 was paid up on debentures in the six months covered by the accounts; and of the total capital called up and borrowed, £853,298 has been spent (a net sum of £2991 in the past half year)—leaving a balance of £26,702 in hand. The other statements in the accounts are reproduced below.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—				
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£74,711 16 9			Common gas, per meter, at 2s. 6d. and 2s. 9d. per 1000 cubic feet	£129,289 16 6		
Salaries of Engineers, Superintendents, and other Officers at works	2,099 10 0			Public lighting and under contracts, common gas. (See statement No. 10.)	9,382 13 10		£138,672 10 4
Wages (carbonizing)	19,251 18 7			Meter-rental	£1,992 8 0		
Purification, including £1783 13s. 4d. for labour	4,329 2 5			Stove-rental	791 16 9		
Repairs and maintenance of plant and works, materials and labour (less £202 13s. received for old materials)	14,904 12 2					2,784 4 9	
Distribution of gas—		£115,296 19 11		Residual products—			
Salaries and wages of Officers (including Rental Clerks)	£2,232 1 2			Coke, less £3647 2s. 9d. for labour	£23,458 2 1		
Repairs, maintenance, and renewals of mains, service-pipes, and fittings, including labour	1,972 15 0			Tar	7,186 15 11		
Repairs and renewals of meters and stoves	2,059 12 1			Ammoniacal liquor and sulphate	8,584 19 9		
Public lamps—		6,264 8 3			£39,179 17 9		
Lighting and repairing		2,284 16 1		Less loss on breeze, after deducting £825 19s. 8d. for wages	19 7 4		
Rent, rates, and taxes		5,950 7 1				39,160 10 5	
Management—				Miscellaneous receipts—			
Directors' allowance	£1,250 0 0			Rents	£330 4 3		
Company's Auditors	75 0 0			Transfer fees	26 5 0		
Salaries of Secretary, Accountant, and Clerks	1,109 18 0					346 9 3	
Collectors' salaries and commission	1,489 9 4						
Stationery and printing	490 3 4						
General charges	536 6 10						
		4,950 17 6					
Bad debts		702 9 4					
Law and parliamentaty charges		384 14 3					
Superannuations		628 18 0					
Official Officers		58 12 3					
		£136,522 2 8					
Balance carried to profit and loss, net revenue account (No. 5)		44,441 12 1					
		£180,963 14 9				£180,963 14 9	

No. 5.—PROFIT AND LOSS (NET REVENUE ACCOUNT).

Interest on debenture stock	£3,685 12 9	Balance, June 30, 1892	£38,350 10 10
Balance available for dividend, carried to balance-sheet	41,502 8 7	Amount from Reserve Fund	5,654 9 2
			£44,005 0 0
		Less—Forfeitures imposed for impurity in the gas, £5; and dividend paid to June 30, £44,000	44,005 0 0
		Balance from revenue account (No. 4)	£44,441 12 1
		Dividends and interest balance	746 9 3
	£45,188 1 4		£45,188 1 4

No. 6.—RESERVE FUND.

To Amount carried to Net Revenue	£5,654 9 2	Balance on June 30, 1892	£44,379 5 1
Balance on Dec. 31, 1892	38,724 15 11		
	£44,379 5 1		£44,379 5 1

No. 7.—INSURANCE FUND.

Balance on Dec. 31, 1892	£29,452 7 7	Balance on June 30, 1892	£29,452 7 7
	£29,452 7 7		£29,452 7 7

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, June 30, 1892.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, Dec. 31, 1892.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	14,108	123,611	110,457	150	27,112
Cannel	1,877	1,422	78*	—	3,221
	15,985	125,033	110,535	150	30,333

* 109,054 gallons of petroleum spirit (lower grade) used as a substitute for cannel.

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

——	In Store, June 30, 1892.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, Dec. 31, 1892.
Coke—chaldrons of 36 bushels*	24,883	147,328	50,392	111,882	9,887
Breeze do. do.	3,766	16,831	5,400	14,471	726
Tar—gallons	162,600	1,124,271	—	1,045,641	241,230
Ammon. liq.—butts of 108 gals.	8,440	34,595	34,983	—	8,052
Sulphate of ammonia—tons	220	1,197	—	914	503

* Under "Weights and Measures Act, 1878."

No. 10.—STATEMENT OF GAS MADE, SOLD, ETC.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
		Public Lights and under Contracts (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,122,935	59,074	972,222	1,031,296	15,384	1,046,680	76,255	5,372

BALANCE-SHEET.

To Capital—				By Cash at Bankers			£3,474 18 9
Balance per account No. 3		£26,702 2 6		Cash in hand for current expenditure			2,900 0 0
Net Revenue—				Amount invested in Consols			68,177 3 6
For balance, per account No. 5		41,502 8 7		Stores in hand—			
Reserve Fund—				Coals	£21,648 19 2		
For balance, per account No. 6		38,724 15 11		Coke	2,780 12 6		
Insurance Fund—				Ammoniacal liquor and tar	8,880 18 7		
For balance, per account No. 7		29,452 7 7		Sundries	7,139 13 7		
Unclaimed dividends		1,900 19 2				40,450 3 10	
Deposits		9,305 8 8		Accounts due to the Company—			
Interest on debenture stock		223 15 0		Gas-rental, quarter ending Dec. 31, 1892	£87,561 4 1		
Sundry tradesmen and others, for amount due for coals, stores, and sundries		19,128 19 9		Arrears outstanding	777 9 10		
Loan from Bankers		45,000 0 0				88,338 13 11	
				For coke and other residual products	£8,411 15 2		
				Sundries	188 2 0		
						8,599 17 2	
		£211,940 17 2					£211,940 17 2

THE GAS-WORKS PURCHASE QUESTION AT CARDIFF.

A writer in the *Western Mail* has been making some calculations to see what the Cardiff Gas-Works would cost on the basis which has been adopted for the transfer to the Local Authority of those belonging to the Barry and Cadoxton Gas and Water Company. The results of his investigations he has embodied in an article headed "The Cardiff Gas Blunder," which reads as follows:—

As the Barry and Cadoxton Local Board, more alive to the interests of the ratepayers they represent than the Corporation of Cardiff, have entered into an agreement to take over the gas and water works in their district, it will be interesting to ascertain the value of the Cardiff Gas-Works on the basis for purchase which has been adopted at Barry. The figure at which the works are to be transferred by the Barry and Cadoxton Gas and Water Company to the Local Board is £169,000; and the basis adopted by Mr. Oxley, a professional expert engaged by the Board, in arriving at the value of the works was as follows: The maximum dividend which the Company could earn upon its present capital was £6224 a year. This figure, if the purchase extended over the customary period of 23 years, would represent £143,152. The total maximum retrospective dividends amounted in the gross to £19,214, of which £6650 had been paid, so that there would be a deficiency of £12,564. The present value of this sum was equal to £6973—total £150,125, to which must be added 10 per cent. for compulsory purchase (£15,021); making a total of £165,137. Added to this would be parliamentary and other expenses, £3000; remuneration of the Directors, £3000; debentures remaining, £17,000—grand total £188,137. To earn the maximum dividend, however, there must be an additional expenditure on the part of the Company of £20,000, the present value of which was £17,262. This, deducted from the grand total named, would leave £170,875, being the price which Mr. Oxley calculated the arbitrator would award; but the Local Board succeeded in arriving at an agreement by which they will take over the works at £1875 less than the valuation. Taking the last half-yearly balance-sheet of the Cardiff Gas Company, and adopting the same principle, the figures will work out as follows:—

Net profit for half year ended Dec. 31, 1892, £11,126, making the annual net profit	£22,252
Which, multiplied by the number of years	23
Gives	£511,796
Add 10 per cent. for compulsory purchase	51,179
„ Temporary loans	62,002
„ Parliamentary expenses	3,000
„ Remuneration of Directors	3,000
Total	£630,977
Amount agreed to be paid by Sub-Committee	505,000
	£125,977
Deduct new capital	27,429
Leaving in excess of the agreed sum	£98,548

It will be seen from the above table that, on the basis accepted by the Barry and Cadoxton Local Board, the Corporation of Cardiff would have to pay £630,977 for the gas-works at the present time. The amount which the Sub-Committee recommended the Corporation to pay in 1890 was £505,000; and they knew at the time that this sum would be accepted. After making allowance for the £27,429 which the Company have since expended on the works, it will be seen that the ratepayers of Cardiff have lost close upon £100,000. There is, however, another point to consider. The Barry and Cadoxton Local Board have to make up the past dividends of the Company to the maximum of 10 per cent., which will absorb £12,564; and, further, the calculation is made upon a prospective return of 10 per cent. to the investor, although the dividends hitherto paid have only been at the rate of 5 per cent. In the case of the Cardiff Gas-Works, on the other hand, the money which formed the basis of the agreement was actually earned; and the Corporation were not called upon to speculate upon a prospective increase of profits, which might not take place for years. In taking the actual net earnings of the Cardiff Gas Company as against the probable increase in the Barry and Cadoxton Gas and Water Company's profits, we have put the case in a way which not one of those who opposed the purchase three years ago can reasonably object to. The ratepayers of Cardiff had no arrears of dividends to pay; neither could there be a possible doubt about the net earnings being maintained. Had the Barry and Cadoxton Gas and Water Company been actually earning the maximum dividend, it is pretty certain that the Local Board would not have been able to purchase the works at the figure agreed upon. Another basis would have been taken, which, if applied to the Cardiff Gas Company's property, would show a very much heavier loss to the town than £98,548. Looked at from any point of view, it is clearly apparent that, in refusing to adopt the recommendation of their Sub-Committee in 1890, the Corporation of Cardiff committed one of the gravest blunders which have ever been laid to their charge.

Renewed Opposition to the Accrington Gas and Water Bill.—At a special meeting of the Accrington Town Council last Tuesday, it was decided that the opposition to the Bill of the Gas and Water Company should be continued in the House of Commons; and, as will be seen by our "Parliamentary Intelligence," the Corporation and the Local Authorities associated with them have duly presented a petition against the Bill.

The Improvements in the Water Distribution System at Liverpool.—Mr. J. Parry, the Water Engineer of the Liverpool Corporation, has prepared a report with regard to an additional supply of water to the city from the Prescot and other works. He recommends that new mains be laid from Prescot and between Edge Lane and Kensington; and also that a new high-pressure engine should be provided at Aubrey Street. The total estimated cost of the mains he places at £139,100, and of the engine, with the necessary pumps and boilers, and connections to the present high-level tank, at £10,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The manufacture of oil gas seems to be in the air. I have just learned that Mr. John Laing, whom I mentioned in not over laudatory terms in my last week's "Notes," and who is, after all, an Edinburgh gentleman, only his scientific degrees being derived from London, is the inventor of an oil-gas plant which it is probable will be adopted soon by a town of considerable size in Scotland. Meanwhile, the process of Mr. Young, of Peebles, is the one which may be said to hold the field. This week, the Hamilton Town Council have, subject to negotiations as to royalties, resolved to adopt it. A report by Mr. W. Ewing, the recently-appointed Gas Manager, pointing out the advantages of the process, was submitted by the Gas Committee; and it was adopted unanimously. Mr. Ewing estimates that the necessary plant will cost £900; and that the annual saving by its working will be £1053. Besides the introduction of oil gas, the Corporation are considering whether they should engage in the manufacture of sulphate of ammonia; and they gave instructions to Mr. Ewing to inquire as to the cost of plant.

A writer in the *Glasgow Herald*, on Monday of this week, calls attention to the Alexander-Paterson process of oil-gas making; giving, as his prefatory reason for writing the article, that "any discovery or improvement on existing methods, which will give a gas of greater illuminating power, and, at the same time, of a purer quality and at a cheaper price than what is usually supplied to the public, cannot fail to be of general interest." The system is worked by the Patent Paraffin Gas Lighting Company, Limited, of Glasgow, who have, the writer says, been able to get it introduced into upwards of fifty country houses and other buildings where gas is made on the premises. In a description of the plant which is given, it is stated that the oil is introduced into the retort by a number of horizontal pipes which, after running the length of the retort, discharge at the back. In that way, the oil, it is said, is partially gasified in the pipes; and the gasification is completed as it travels forwards to the ascension-pipe. No washing or scrubbing is required; the gas, after condensation, being sent into the holder. The patent for the invention was taken out in 1885, and was, of course, noticed in the JOURNAL "Register." Trials have been made in the mixing of oil gas with Glasgow coal gas; but the writer is disappointingly silent as to whether these have been recent, or whether they have been already published. The result of the trials was that the cost of production of the oil gas for oil, fuel (coke being used for firing), and labour, was about 3s. 4¾d. per 1000 cubic feet. It is a pity to find fault with an article which might have been very useful; but a disappointment comes in, in the fact that the writer does not give the illuminating power of the Glasgow gas before enriching and after, nor the cost either of the coal gas or of the enriched gas. These are serious defects, because they take away from the practical value of the article. But, defective though it is, it will do good if it institutes inquiry into the merits of the system.

The North Berwick Town Council had before them on Monday the subject of the acquisition of the undertaking of the local Gas Company. A letter from the Secretary of the Company was submitted, in which it was stated that the Directors declined to supply any information to the Council regarding their works, unless the Council gave the necessary notice under the Burghs Gas Supply Act. Provost Brodie said they had tried to be friendly; but as the Company had taken up the position they had done, there was nothing for it but to proceed formally under the Act, and ask them to put a value upon their property. It was agreed to send formal notice to the Company.

It has been resolved to reconstruct the Cupar Gas Company, in the form of a co-partnery, as it has hitherto existed, and not as a limited liability Company. A meeting of the members of the co-partnery was held on Thursday, at which a Sub-Committee's report, recommending a renewal of the contract for a further period of 25 years, was agreed to. Mr. A. MacPherson, of Kirkcaldy, it was reported, had valued the works and plant of the Company at over £6000, which was an increase of £1500 upon the figure ascertained twenty years ago.

It was reported to the Dundee Gas Commission on Wednesday that the total expenditure upon the electric lighting installation they have just started had been £28,030. The Commissioners have already had permission to borrow £20,000 under their Provisional Order; and it was agreed to apply for power to borrow other £10,000—it being considered advisable to have £2000 in hand to meet the cost of extensions.

The Sub-Committee of the Edinburgh Town Council who have charge of the proposed electric lighting scheme, have resolved, by eight votes to three, to recommend that the Corporation shall retain the working of the installation in their own hands. At a meeting of the Edinburgh Merchants' Association on Wednesday night, Mr. J. M. Turnbull moved that they petition the Town Council not to take up the working of the electric light, but that they should hand it over to a public company. It was a dead certainty, Mr. Turnbull said, that there would be a loss to the city in working it. The motion was adopted by a majority of ten votes to four.

An all but unrecorded failure of the electric light in Glasgow took place on the evening of Friday, March 31. I see almost all the Glasgow newspapers, and only one of those which came under my notice mentioned the circumstance. Even that paper seemed inclined to say as little about it as possible; the fact of about two miles of street having been left in darkness on one side being only worth a four-line paragraph without a heading. The information was, however, given that there was a partial hitch in the machinery.

The Carnoustie Police Commissioners, after declining to accept the offer made by the Dundee Water Commissioners for a supply of water for the burgh, and proceeding to investigate for a local supply, have now come to terms with the Dundee Commissioners. The Water Commissioners this week approved of the agreement which has been come to. Under it, the Dundee Water Commissioners are to construct a reservoir and lay down the necessary piping, and to supply a mixture of Lintrathen and Crombie water; and the Carnoustie Police Commissioners are to pay £350 a year for the first five years, and £400 for the succeeding five years.

The County Council of the Middle Ward of Lanarkshire have accepted the offer of Messrs. R. M'Laren and Co., of Glasgow, to supply the cast-iron pipes for a large scheme of water supply for a number of villages in the Strathaven district, which the Council are promoting. The contract price is £47,807. Messrs. J. Young and Sons, of Edinburgh, have secured the contract for the construction of the reservoir at Glengavel, in connection with the scheme. Their offer was £56,984.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 8.

Sulphate of Ammonia.—There have been very few orders on the market this week; and evidently a holiday feeling still prevails. An opportunity is sought by the dealers to utilize this quietness for purposes of depression; and quotations have, in consequence, become somewhat irregular. Still there is a steady undertone; and therefore no cause for alarm, as far as producers are concerned. The tone of the market is also somewhat influenced by cheap forward sales of Scotch makes; and the action of these producers in this respect seems a most curious one. To-day's values at the ports may be called £12 10s.; but re-sales at less money are reported. The quantity offering is small; and the extent of the requirements will sway the market. Nitrate is firm at 10s. 6d. per cwt.

LONDON, *April* 8.

Tar Products.—This market is extremely dull; but probably a good deal is due to the holidays. Benzols are quotable at less money; and, owing to the wretched condition of the aniline trade, buyers have for the present withdrawn from the market entirely. The only hope for distillers as regards benzol is that these low prices must close the carbonizers' works. Pitch scarcely maintains its value; and no new business of any importance is reported. Unless the Tar Products Sales Committee take this article in hand, the price is sure to be lower, notwithstanding the reduction of output, which is now making itself felt. Anthracene nominally maintains its value, and appears to be firmly held. To-day's prices are: Tar, 12s. 6d. Pitch, 24s. to 25s. 6d. Benzols, 90's, 1s. 7d.; 50's, 1s. 5½d. Solvent naphtha, 1s. 1½d. Toluol, 1s. 4½d. Crude benzol naphtha, 30 per cent., 7d. Creosote, ¾d. Creosote salts, 17s. Carbolic acid, 60's, 2s. 4d.; 75's, 2s. 10½d.; crystals, 7½d. Cresol, 2s. Anthracene, nominal, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—This market is very strong. Makers are still short of quantities sold; and £12 15s., less 3½ per cent., is easily obtainable for prompt delivery. Very little new business is mentioned, as makers, unfortunately tempted by the higher prices a month or two ago, sold largely ahead. Gas liquor is quoted at 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—As regards all descriptions of round coal, a continued slackening off in the demand is reported generally; and the orders coming to hand are barely sufficient to keep collieries going more than about half-time. The demand for the better qualities is much below the average for the season of the year. The leading Manchester firms still hold to list rates; but in other districts there is a more or less general easing down, and in many cases prices have given way about 3d. to 6d. per ton. At the pit mouth, best Wigan Arley now scarcely averages more than 11s. 6d. to 12s. per ton; Pemberton four-feet and second qualities of Arley, about 10s.; and common house-fire coals, about 7s. 6d. to 8s. per ton. The decreased requirements for house-fire consumption are throwing a good deal of the lower qualities of round coal upon the market, which is tending to render common coals still more difficult to dispose of; and list rates for these are practically non-existent—collieries having to take any prices they can get to move off their surplus supplies. At the pit, 6s. 6d. to 7s. per ton represents quite the average figures for ordinary descriptions of steam and forge coals. With regard to gas coal, the Manchester Corporation have been asking for tenders rather earlier than usual this year, and these have now been in for some time; but so far nothing appears to have been settled. Apart from any wages question, there seems to be every probability that very low prices will in any case rule for the supply of gas companies, owing to the large surplus supplies of all descriptions of round coal upon the market. Engine classes of fuel are in active demand generally; and although some of the collieries still hold considerable stocks of slack, there is rather a scarcity in some descriptions, and prices show a decided hardening tendency—advances of about 3d. per ton being in some cases got upon the figures that have been taken recently. At the pit mouth, good qualities of burgy are fetching from 6s. 3d. to 6s. 9d.; the best qualities of slack average quite 4s. 9d. to 5s. 3d.; and inferior sorts are very firm at 3s. 6d. to 4s. per ton, as the minimum. The shipping trade remains in a very unsatisfactory condition; and excessively low figures have to be taken to effect sales of anything like quantities—8s. for steam coal at the ports on the Mersey being about the average figure.

Northern Coal Trade.—There has been rather more activity in the demand for steam coals of late; but prices have not moved upwards, the supply being extremely large. Best Northumberland steam coals are in fuller demand; and the price of about 8s. 6d. per ton f.o.b. is now generally adhered to—most of the collieries having now full work. Second-class steam coals are about 8s. per ton; and there is scarcely so large an inquiry for this class as there is for best steam, some collieries having still inadequate work. Small steam coals are being more freely shipped, and command from 3s. to 3s. 3d. per ton. Gas coals are still in fair demand; though the local consumption now falls, there is a larger shipment as the Baltic ports open. Prices of gas coals vary much. Generally, about 6s. 6d. per ton f.o.b. is the quotation; but whilst some coalowners are willing to take less, in one or two instances a higher price is asked, and there are similar variations in the tenders that are given for contracts. Coke is slightly weaker—best Durham qualities being quoted from 13s. 6d. to 14s. 6d. per ton; but the local consumption is still very heavy. There is no alteration in the price of gas coke; and the output, being now reduced, is taken up better than it was a few months ago.

Scotch Coal Trade.—There is still no improvement in the coal trade in Scotland—in fact, if any change is perceptible, it is a more pronounced slackness. This is partly owing to exceptionally warm weather which has been experienced; and there is also a great scarcity of foreign orders. Splint and steam coals are especially stiff to sell. The miners, working four days a week, are more than able to meet demands. This week the prices quoted are: Main, 6s. to 6s. 3d.; ell, 6s. 10d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 8s. to 8s. 3d. per ton f.o.b. Glasgow. Shipments again show a decline. For the week they amounted to 141,127 tons—a decrease as compared with the preceding six days of 9854 tons, and as compared with the corresponding week of last year of 11,206 tons. For the year to date, the total shipments have amounted to 1,386,141 tons—a decrease of 140,641 tons.

The Brighton Corporation Electric Lighting Scheme.—At the meeting of the Brighton Town Council last Thursday, the Town Clerk read a letter from the Local Government Board, stating that they had decided to sanction a loan of £30,000 for electric lighting purposes, on the understanding that the Council will, without delay, make a further application for authority to borrow such additional amount as may be necessary to cover the excess expenditure which has taken place.

Sales of Shares.—Messrs. Day and Sons recently sold by auction 24 £10 original 10 per cent. shares in the *Maidstone Water Company* for £28 each, and a number of ordinary £10 shares for £18 10s. apiece. ——Messrs. Field and Palmer have recently sold, at Southsea, a large parcel of original £10 shares in the *Portsmouth Water-Works Company*, at prices ranging from £28 to £28 2s. 6d. each.——At Maidstone last Friday, ten £20 shares in the *Gravesend and Milton Water-Works Company* realized £58 each, and two £58 10s. each.——At Tonbridge £340 of "A" and "B" stock in the *Tonbridge Gas Company* sold as follows: Two £50 lots of "A" stock, £107 10s. each; £70 "A" stock, £150; £50 "B" stock, £76; £50 "B" stock, £77; and £70 "B" stock, £108. Ten new shares in the *Tonbridge Water Company* (with £3 5s. paid) have changed hands at £4 per share.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 629.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	17—18	..	5 16 8
100,000	10	"	7½	Do. 7 p. c	10	12—13	..	5 15 5
300,000	100	3 Jan.	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 2
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12	..	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	5⅞—6⅛	..	6 0 0
40,000	5	"	7½	Do. New	4	4—4⅛	..	6 13 4
380,000	Stck.	24 Feb.	11½	Brentford Consolidated	100	215—219	..	5 5 0
180,000	"	"	8½	Do. New	100	168—173	..	4 18 3
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sep	11½	British	20	42—44	..	5 2 3
50,000	10	15 Mar.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	14⅜—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	6—7	..	—
200,000	100	3 Jan.	6	Do. 6 p. c. Deb.	100	98—100	..	6 0 0
150,000	20	24 Feb.	8	Cagliari, Limited	20	24—26	..	6 3 1
550,000	Stck.	14 Oct.	12½†	Commercial, Old Stock	100	245—250	..	5 0 0
165,000	"	"	9½†	Do. New do.	100	187—192	..	4 18 11
160,762	"	15 Dec.	4½	Do. 4½ p. c. Deb. do.	100	127—132	..	3 8 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited	100	229—234	+2	5 11 1
200,000	"	"	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	187—192	..	5 4 2
486,090	10	27 Jan.	10	European, Limited	10	21—22	..	4 10 11
354,060	10	"	10	Do. Partly paid	7½	14⅜—15⅜	..	4 17 0
5,596,560	Stck.	10 Feb.	12	Gaslight & Coke, A, Ordinary	100	220—225	..	5 6 8
100,000	"	"	4	Do. B, 4 p. c. max.	100	95—99	..	4 0 10
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	115—120	..	4 3 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	165—170	..	4 8 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	166—170	..	4 2 4
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	260—265	..	3 15 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	154—158	..	3 16 0
1,061,150	"	15 Dec.	4	Do. 4 p. c. Deb. Stk.	100	123—126	..	3 3 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	127—132	..	3 8 2
903,000	"	"	6	Do. 6 p. c. do	100	167—172	..	3 9 9
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	228—231	+1	5 3 10
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4⅛—5	..	6 0 0
560,000	100	4 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	105–107*	+½	4 13 4
541,920	20	16 Nov.	5	Monte Video, Limited	20	13½—14½	..	6 18 0
150,000	5	30 Nov.	10	Oriental, Limited	5	7⅛—8⅛	..	6 1 2
60,000	5	29 Mar.	7	Ottoman, Limited	5	4—4⅛*	..	7 7 4
166,870	10	—	2	Para Limited	10	2—2½	..	—
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	and Do.	100	100–105	..	5 14 3
150,000	10	—	10	San Paulo, Limited	10	9—10	..	—
500,000	Stck.	24 Feb.	15½	South Metropolitan, A Stock	100	290—295	..	5 5 0
1,350,000	"	"	12	Do. B do.	100	238—243	..	4 18 9
230,000	"	"	13	Do. C do.	100	245—250	..	5 4 0
750,000	"	13 Jan.	5	Do. 5 p. c. Deb. Stk.	100	145—148	..	3 7 7
60,000	Stck.	15 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
744,897	Stck.	30 Dec.	10	Chelsea, Ordinary	100	262—266	..	3 15 3
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	210–214*	−1	3 14 10
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	142—145	+1	3 2 1
700,000	50	15 Dec.	8½	Grand Junction	50	110—113	..	3 15 2
708,000	Stck.	10 Feb.	11	Kent	100	277—282	..	3 18 0
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	238—243	+1	3 18 2
406,200	100	"	7½	Do. 7½ p. c. max.	100	197—202	..	3 14 6
285,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129–132*	..	3 0 7
500,000	100	10 Feb.	12½	New River, New Shares	100	323—328	..	3 14 0
1,000,000	Stck.	27 Jan.	4	Do. 4 p. c. Deb. Stk	100	133—137	..	2 18 5
902,300	Stck.	15 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	162—167	..	3 17 10
126,500	100	"	6½	Do. D 7½ p. c. do.	100	145—150	..	4 6 8
1,155,066	Stck.	15 Dec.	10	West Middlesex	100	260—265	..	3 15 6

*Ex Div.

† Next dividend will be at this rate.

Kimberley Water-Works Company, Limited.—In their report for the past year, the Directors of this Company state that the working account shows a profit of £26,345. After payment of the interest on debentures and debenture stock, the net available profit is £19,868, out of which an interim dividend of 2½ per cent. has been paid. The Directors propose to pay a further 2½ per cent.—making 5 per cent. for the year—and to write off £4118.

Sittingbourne and Milton Water Supply.—The Milton Improvement Commissioners have appointed a Committee to prepare an estimate of the probable cost of new water-works for the Sittingbourne and Milton district. It is stated that there is plenty of water obtainable, and that water-works could be erected for something like £2000—the amount which the Milton authority have offered to the Sittingbourne Local Board for a share and interest in their water-works, and which the latter body has refused.

Tarapaca Water-Works Company.—In the fifth annual report of this Company, the Directors state that the net profits for the year are £40,729, which, with the £19,243 brought forward, make a total to the credit of profit and loss account of £59,972. On Sept. 15 last an interim dividend of 5 per cent. was paid; leaving £39,972 disposable. Out of this amount, the Directors propose to pay a further dividend of 5 per cent.—making 10 per cent. for the year; and to carry forward the balance (£19,972). The total sale of water shows a slight decrease compared with that of 1891, caused by the limitation of the nitrate output, the consequent decreased consumption by the Railway Company, and diminished trade at the port of Iquique. The port of Pisagua is now being supplied by Pica water through the Company's steamers from Iquique, which will, it is expected, effect an economy in working and an increase in consumption.

Proposed Increase in the Price of Gas at Middlesbrough.—At a recent meeting of the Middlesbrough Corporation Gas Committee, two proposals were made to increase the price of gas respectively by 2½d. and 5d. per 1000 cubic feet; but they were both defeated. The Chairman (Alderman Hugh Bell) intimated that he would raise the question at the next meeting of the Council. The price is at present 2s. per 1000 cubic feet net. A local contemporary says that the suggested increase has caused much indignation. "It is true," it goes on to remark, "that, as compared with other towns, the existing charge is exceedingly cheap; but the opponents of any increase contend that, up to the present time, the gas-works have not only been able to pay their way, but to make a handsome contribution out of their profits towards the rates. Doubtless the heavy expenditure which the Committee are now incurring in extensions and renewals at the works have led some of them to consider the question of increasing the price of the commodity they supply; but it has been urged in opposition to such a proposal that it would only be fair to make the undertaking self-supporting, and no more, seeing that there are many owners of property in the borough who do not live in it, and who would, if the price of gas were increased to make a larger profit, be profiting by the consequent reduction of the rates at the expense of the consumer."

Gas Workers' Union.—The anniversary demonstration of this Union took place on Sunday, the 2nd inst., at Barking Road. There were two platforms, at the first of which Mr. H. Pickard took the chair; at the second, Mr. Mark Hutchins, President of the Union. The General Secretary (Mr. W. Thorne) said the employers in different parts of the country were banded together to suppress the New Trade Unionism. The success of that policy depended upon the action of the workers themselves. He congratulated them on the position and prospects of the Union; and expressed the hope that they would never rest content until they obtained possession of the wealth they created by their labour. Mr. J. Burns, M.P., said that, of all the Unions with which he had worked, there was none whose economic basis, general policy, and political action pleased him so well as that over which Will Thorne so worthily and honestly presided. Their Union had won many notable victories; and out of the ashes of its few defeats, it had managed to snatch some advantages. Its parliamentary and municipal programme was the logical complement of its Trade Union weapons. Its income during the past year had been £14,100; and, while it had spent £5480 as strike pay, it had £5100 in the bank—£2000 more than in January, 1892. The sound financial character of the Union was due in no small measure to the honesty and integrity of its officers. The policy of the Union from the beginning had been to recognize that Trade Unionism of itself could not obtain for the workers that which they required; and hence the wise plan had been adopted of invoking municipal action and parliamentary aid. The following resolution was put simultaneously from both platforms, and carried unanimously: "That this meeting of London working men and working women hereby pledges itself to support their respective Trades Unions, and also to return Labour men to all the governing bodies of the country, in order to secure for themselves a fair return for their labour."

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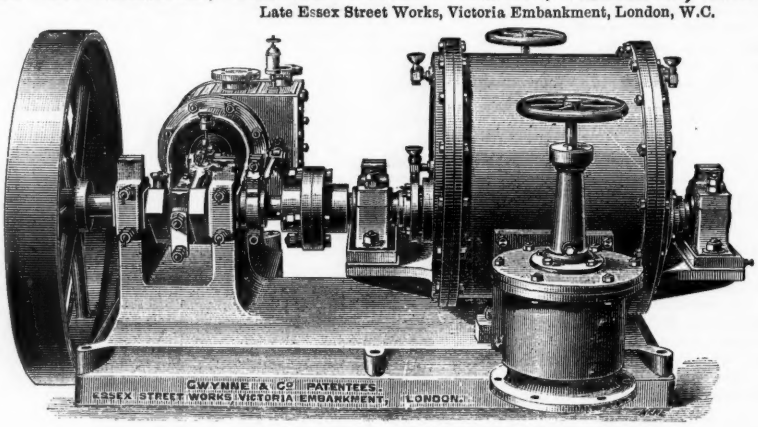

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THE Ennis Gas Consumers' Company, Limited, require the services of a Man as MANAGER and GAS-FITTER. Must be a good Carbonizer, layer of Mains and Services, and understand the repairs of Meters. Salary, 30s. per week, with House, Fuel, and Light free. Send testimonials with application.
Address the SECRETARY, Gas-Works, Ennis, Co. CLARE.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

IN consequence of the Amalgamation of the Rushden and Higham Ferrers Gas Companies, and the erection of entirely new Works, the Directors of the above Company have the following PLANT FOR SALE:—
One TWO-LIFT GASHOLDER. Outer Lift, 35 ft. by 15 ft.; inner do., 33 ft. 6 in. by 15 ft.
One SINGLE GASHOLDER, 35 ft. by 12 ft.
One TWO-LIFT GASHOLDER, 30 ft. by 20 ft.
SCRUBBER.
PIPE and ANNULAR CONDENSERS.
PURIFIERS.
STATION METERS.
RETORT IRONWORK, HYDRAULIC MAINS.
Various VALVES and CONNECTIONS.
For particulars and permission to view, apply to JNO. T. LEWIS, Engineer, Gas-Works, WELLINGBOROUGH.

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

WANTED, Gas Liquor.
Address GEORGE DOBSON, LIMITED, CARDIFF.

WANTED, Offers for 500 good, sound, 40-Gallon CRUDE NAPHTHA BARRELS.
Address C 49, Post Office, HUDDERSFIELD.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

FOR SALE, at the Redhill Gas-Works, Surrey—Four 12 feet square PURIFIERS, 6 feet deep, with Centre-Valve and Traveller, T-iron Bearers, and Wood Grids, complete, price £250.
Applications to undersigned.
C. READ,
Manager, &c.

FOR SALE—One Gasholder 36 feet diameter by 15 feet deep.
One GAS-METER 4 feet diameter by 4 feet long, registers to 10 millions, with clock, 6-inch inlet.
Five GAS-RETORTS (Fire-clay), have not been used.
Apply to H. TODD, Jarrow Chemical Works, SOUTH SHIELDS.

THE Camborne Gas Company, Limited, invite TENDERS for about 750 tons of COAL, delivered f.o.b. to the order of the Company between June, 1893, and June, 1894; also for about 250 tons of SILKSTONE.
Sealed tenders, endorsed "Tender for Coal," to be addressed to the undersigned on or before the 20th inst.
The Directors do not bind themselves to accept the lowest or any tender.
W. BAILEY,
Secretary.
Camborne, April 8, 1893.

WIRKSWORTH GASLIGHT & COKE COMPANY.

TAR AND LIQUOR.

THE above Company are prepared to receive TENDERS for TAR and LIQUOR made at their Works from May 1, 1893, to April 30, 1894.
Probable quantity: Tar, 8000 gallons; Liquor, 12,000 gallons.
The Tar will be placed on Rail in Buyer's Tanks at the Wirksworth (Midland) Station.
Sealed tenders, endorsed "Tar" or "Liquor," must be sent to the Chairman (T. Newton, Esq.), on or before the 25th day of April.
JAMES LEE, Secretary.

CORPORATION OF ROTHERHAM.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply and erection of a BEALE GAS EXHAUSTER, to pass 80,000 cubic feet per hour.
Particulars and Form of Tender may be had on application to the Gas Engineer, Mr. C. B. Newton.
The Contractor whose tender may be accepted by the Corporation is required to pay his workmen (whether artisans or labourers) not less than the minimum standard rate of wages paid in Rotherham and District for the time being in each branch of trade, and to observe the recognized hours and proper conditions of labour.
Tenders to be delivered, sealed, at the Town Clerk's Office, Rotherham, not later than Wednesday, the 19th inst., endorsed "Tender for Exhauster."
By order,
H. H. HICKMOTT,
Town Clerk.
Council Hall, Rotherham,
April 8, 1893.

CORPORATION OF ROTHERHAM.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply and erection of a WASHER-SCRUBBER, to pass 1½ million cubic feet of Gas per day.
Particulars and Form of Tender may be had on application to the Gas Engineer, Mr. C. B. Newton.
The Contractor whose tender may be accepted by the Corporation is required to pay his workmen (whether artisans or labourers) not less than the minimum standard rate of wages paid in Rotherham and District for the time being in each branch of trade, and to observe the recognized hours and proper conditions of labour.
Tenders to be delivered, sealed, at the Town Clerk's Office, Rotherham, not later than Wednesday, the 19th inst., endorsed "Tender for Washer-Scrubber."
By order,
H. H. HICKMOTT,
Town Clerk.
Council Hall, Rotherham,
April 8, 1893.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; 10, Marsden Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA, SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

LIQUOR and Tar wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

ASHFORD, KENT.

THE Directors of the Ashford Gas and Coke Company, Limited, are prepared to receive TENDERS for the supply of 3000 tons of GAS COALS, to be delivered, at their Works at Ashford (Kent), in equal monthly quantities, from the 1st of July next to the 31st of March, 1894.
Tenders, specifying the description of Coals, the pits at which they are raised, and terms for net monthly payments, to be sent to me on or before Saturday, April 29, endorsed "Tender for Coals."
F. HUGHES-HALLETT,
Secretary.
Ashford, April 8, 1893.

MALVERN LOCAL BOARD.

TENDERS FOR GAS COAL.

THE Malvern Local Board invite TENDERS for the supply of 1000 tons of best double-screened SILKSTONE, and 1000 tons of best double-screened WIGAN GAS COAL, to be delivered and stacked at the Gas-Works, Great Malvern, in such quantities as may from time to time be required, before the 31st of August next.
Tenders, endorsed "Tender for Gas Coal," to be sent to me on or before Saturday, the 22nd inst.
WM. LAMBERT,
Clerk to the Board.
Local Board Offices, Malvern,
April 7, 1893.

TENDERS FOR GAS COAL.

THE Corporation of Droitwich invite TENDERS for the supply of about 1200 tons of best screened GAS COAL, at per ton of 21 cwt., to be delivered free at Droitwich (G.W.) Railway Station at such times and in such quantities as may be required.
The contract will be for One Year, commencing on the 1st prox.
Tenders (with analysis of the Coal to be supplied), properly endorsed "Tender for Gas Coal," to be sent to the undersigned on or before the 22nd inst.
The Corporation do not bind themselves to accept the lowest or any tender.
S. JOHN TOMBS,
Town Clerk.
Droitwich, April 1, 1893.

ULVERSTON LOCAL BOARD.

TENDERS FOR COAL AND CANNEL.

THE Gas and Water Committee invite TENDERS for the supply of best Screened GAS COAL or NUTS and CANNEL for One, Two, or Three Years, commencing the 1st of July next.
Parties tendering must give full particulars of the Coal and Cannel they propose to supply, and name the pit from which the same will be raised.
Further Information and Forms of Tender may be obtained on application to the undersigned.
Sealed tenders to be sent in not later than the 27th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal or Cannel."
The Committee do not bind themselves to accept the lowest or any tender.
JNO. SWAN,
Engineer and Manager.

WALLASEY GAS-WORKS.

TO BUILDERS AND CONTRACTORS.

THE Wallasey Local Board invite TENDERS (one Contract) for the LEVELLING of LAND, DRAINAGE, Construction of BRANCH RAILWAY, Erection of RETORT and PURIFYING HOUSES, ALTERATION to OFFICES, and other WORK connected with New Gas-Works, at Poulton-cum-Seacombe, Cheshire.
Drawings and Specification may be inspected on application to the Engineer, Mr. H. Ashton Hill, Assoc. M.Inst. C.E., at the Gas and Water Works, Great Float, near Birkenhead.
Copy of Specification and Bill of Quantities, with Form of Tender, can be had on and after the 4th day of April, 1893, on payment of Five Guineas, to be returned on receipt of a *bond fide* tender.
Sealed tenders, on the form provided for the purpose, addressed to the Chairman of the Gas and Water Committee and endorsed "Tender for New Gas-Works," to be delivered at my Office, Church Street, Egremont, Cheshire, not later than Five o'clock p.m. on Monday, the 24th of April, 1893.
The Contractor will be required to enter into a bond with approved sureties, for the due performance of the contract, which contract and bond will be prepared at the expense of the Contractor.
The Board do not bind themselves to accept the lowest or any tender.
By order,
W. DANGER.
Public Offices, Egremont,
Cheshire, April 1, 1893.

IMPERIAL CONTINENTAL GAS ASSOCIATION.
INCORPORATED BY ACT OF PARLIAMENT.

NOTICE is hereby given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Association will be held, at the City Terminus Hotel, Cannon Street, London, E.C., on Tuesday, the 2nd day of May next, at 2.30 p.m. precisely, when a Report will be made to the Proprietors, a Dividend declared for the Half Year ended the 31st of December last, and the usual Ordinary Business of such Meeting transacted.

Notice is hereby also given, that the Transfer Books will be closed from the 18th inst. to the 2nd of May, both days inclusive.

And Notice is further given, that an EXTRAORDINARY GENERAL MEETING of the Proprietors will be held on the said 2nd day of May next, immediately after the Half-Yearly Ordinary General Meeting, to consider a proposal of the Board of Directors to authorize the borrowing of a sum of Money on Mortgage, Debenture, or Debenture Stock, in accordance with the provisions of The Imperial Continental Gas Association Act, 1893, and, if approved, to order the same.

By order of the Board,
R. S. GARDINER,
Secretary.

21, Austin Friars, London, E.C.,
April 10, 1893.

CASES FOR BINDING
VOLUMES OF THE "JOURNAL"
(GREEN CLOTH, GILT LETTERED)
Price 2s. each.

NEW **BOX'S** PATENT
RETORT LID-FASTENER.
CANNOT GET OUT OF ORDER.
DOES NOT DAMAGE LIDS.
SIMPLE & EFFECTIVE—CHEAP & DURABLE.
For Prices and Particulars, apply to
W. W. BOX, Gas-Works, Crayford, Kent.
[*Illustrated Description in* JOURNAL, *Vol. LX., p. 346.*]

NOTICE OF REMOVAL.
TO GAS ENGINEERS & MANAGERS.
CROWTHER BROS.,
Contractors for Retort Setting, Erection of Gas Apparatus, and General Repairs, have removed from 384, Mile End Road, to
152, TEVIOT ST., ST. LEONARD'S ROAD,
POPLAR, LONDON, E.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over
400,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

NIDDRIE CANNEL
A FIRST-CLASS CANNEL COAL,
Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO
The Niddrie & Benhar Coal Co., Ltd.,
4, York Buildings, Queen Street,
EDINBURGH.
Telegrams: "BENHAR, Edinburgh."

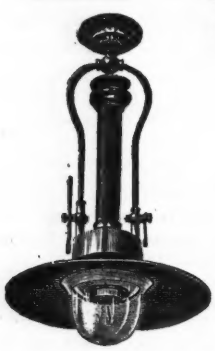
AUG. KLÖNNE,
DORTMUND (GERMANY).
REGENERATIVE FURNACES.
Unsurpassed in
Efficiency, Economy, Durability, and Easy Working.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

THE "METEOR" HIGH-POWER GAS-LAMP.



CLASS B.

The Electric Light's greatest Rival. Has been awarded 8 Gold and Silver Medals.
For inside, and outdoor Lighting.
THE "METEOR" LAMP IS

The cheapest
The simplest
The most economic
The most durable
The most brilliant
The best ventilating
The most easily cleaned
} **Lamp in Existence.**

The best and most suitable Lamp for hiring and hire-purchase. Being made entirely of fine Cast-Iron, the "Meteor" is practically indestructible. Greatly reduced prices. Liberal terms. Write for new descriptive reduced price list.
N.B.—Accessories are now offered at greatly reduced prices.

W. J. MOORE,
Sole Manufacturer's Representative,
83, UPPER THAMES STREET, LONDON, E.C.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE NO. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE,
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. PATTINSON, Public Analyst for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a working Analysis made of these Coals by the Falmouth Gas Company:—

[COPY.]
FALMOUTH GAS COMPANY,
Offices: *Church Street, Falmouth,*
January 25th, 1893.

Messrs. the
WEARDALE IRON & COAL COMPANY, LTD.,
NEWCASTLE-ON-TYNE.

GENTLEMEN,

From the Cargo of **THORNLEY GAS COAL,** received early this month from you, I have Carbonized at these Works, during a period of thirteen consecutive days, 151$\frac{15}{20}$ tons of the Coal, mixed with 9$\frac{6}{20}$ tons of Cannel Shale (or about 6 per cent.)

The Make of Gas during the above period was 1,624,000 cubic feet.

The whole of the Gas was made from four beds of sixes (24 mouthpieces); each charge being of six hours' duration.

Gas made: 1,624,000 cubic feet.
Coal Carbonized: 151$\frac{15}{20}$ tons.
Cannel Shale: 9$\frac{6}{20}$ tons.
Make per ton of Coal and Cannel Carbonized: 10,082 cubic feet.
Coke per ton (of good quality): 13$\frac{1}{4}$ cwt.

The ILLUMINATING POWER averages from 11 daily tests, **16·54 CANDLES,** which was ascertained by burning the Gas at the rate of 5 cubic feet per hour in a certified Letheby Photometer, fitted with a Standard Argand, each Candle consuming 120 grains of Sperm per hour.

Yours faithfully,
J. WM. BUCKLEY,
Engineer and Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.,
QUAYSIDE, NEWCASTLE-ON-TYNE.

WILLEY & Co.,

Gas Engineering Works, Commercial Road, Exeter,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

Shipments Promptly and Carefully Executed.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, near DEWSBURY.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, Limited,

Sheaf & Spring Works,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

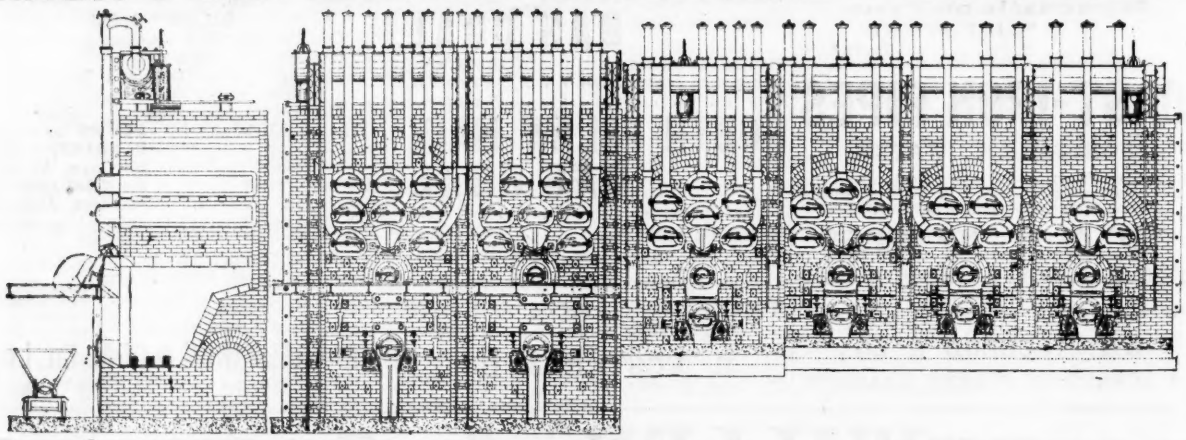
STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
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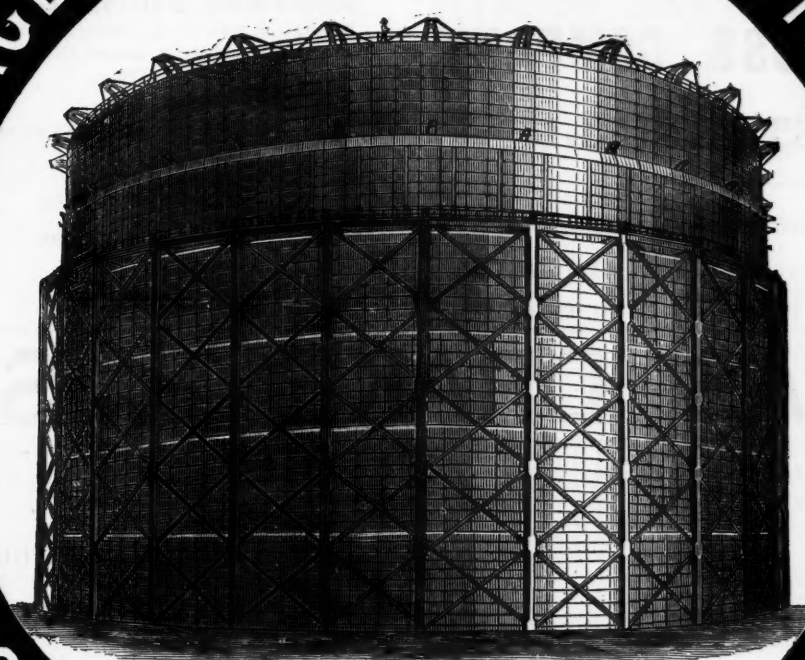

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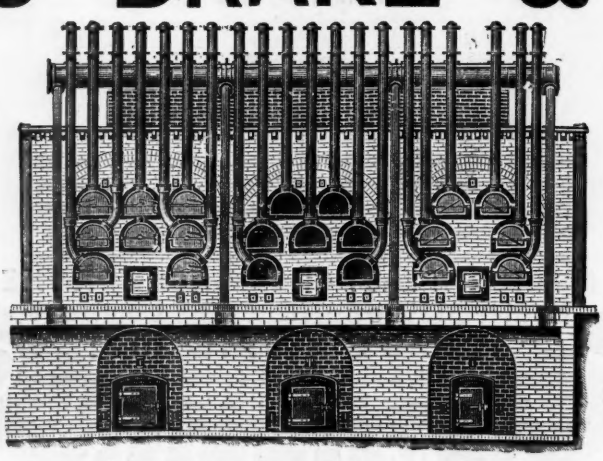

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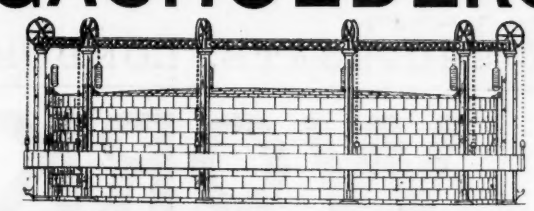

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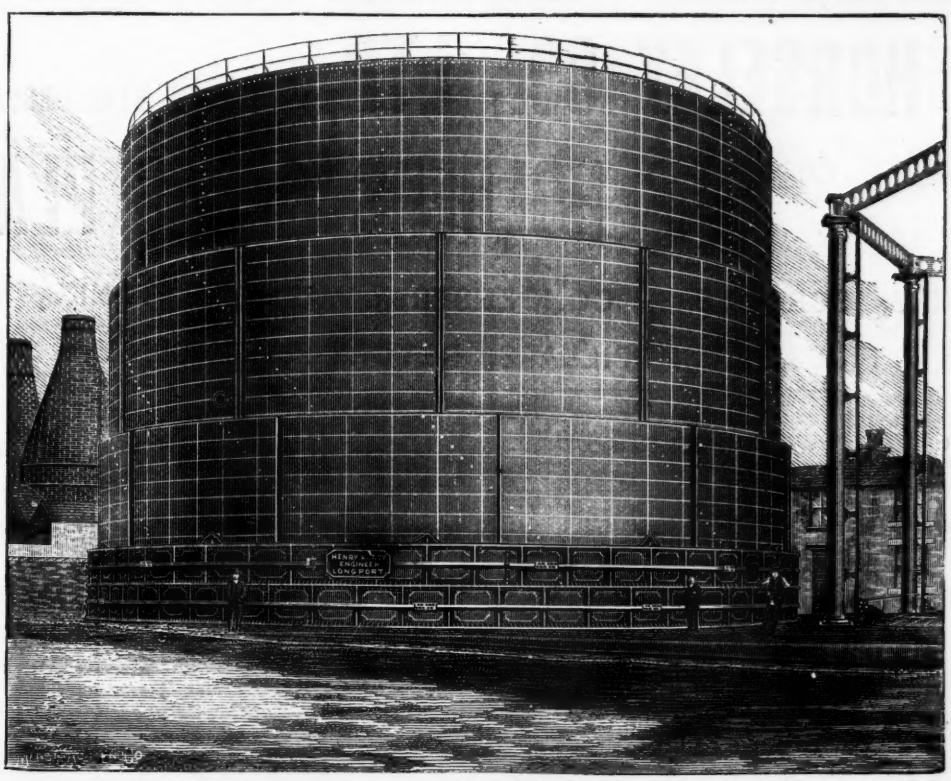

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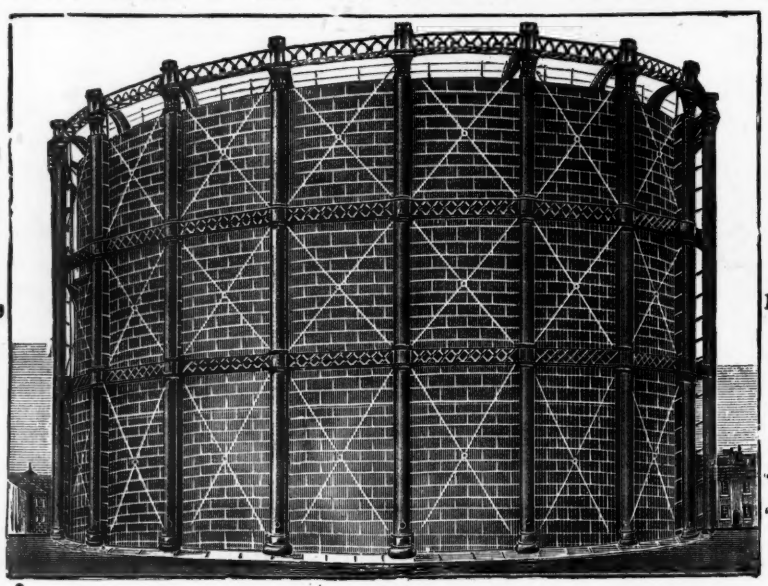

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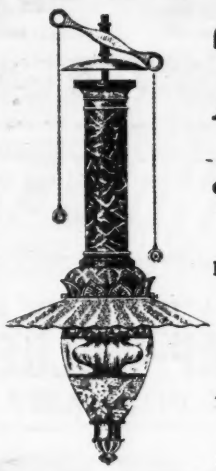

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